2016 Coral Reef Protection Workshop

Save Our Reefs: Reef Safe Tour Operator Workshop

Final Report

Prepared for:
Guam Bureau of Statistics and Plans and
Guam Recreational Use and Misuse Local Action Strategy Working Group

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Summary:

The *Save Our Reefs: Reef Safe Tour Operator Workshop* was held on September 29, 2016 at the Hilton Guam Resort and Spa in Tumon, Guam. This workshop was the third iteration of this workshop and the materials were developed by current and past members of the Recreational Use and Misuse Local Action Strategy Working Group (RLAS). The workshop was coordinated by the University of Guam Marine Laboratory (UOGML) and National Oceanic and Atmospheric Administration (NOAA), with support from the Guam Bureau of Statistics and Plans (BSP) and Guam Visitors Bureau (GVB).

Twenty-five participants attended the workshop including tour operators, dive instructors / divemasters, tourism students, agency personnel, and marine biology students. Attendees learned about coral ecology, the status of Guam's coral reef ecosystems, impacts of climate change on Guam's reefs, recreational impacts, programs to improve stewardship of reefs, and best management practices for tour operators.

Attendees were provided with tools to help address recreational impacts including a guide to best management practices for reef tour operators, self-assessment checklist for managing impacts, and posters and briefing cards with reef friendly practices in English, Japanese, Korean, and Chinese.

As part of the workshop, participants were asked to provide their suggestions for addressing recreational impacts on Guam's reefs. Attendees recommended that this training be offered more frequently in a more condensed format (less than 2 hours). Additional recommendations were to expand the Tasi Beach Guide program to include more guides and host hotel and tour presentations; engage business owners more; create a marine tour operator association or working group; improve enforcement capacity and utilize existing legislation more effectively (Marine Preserve Eco-Permit); and provide positive feedback by showcasing tour operators that are implementing BMPs.

Background

The RLAS first hosted a recreational user workshop in 2004. The Galaide group was hired to coordinate the workshop, including workshop logistics, identifying and inviting participants, and facilitating the workshop. This workshop was well attended as it introduced the Marine Preserve Eco-Permit and the draft regulations. The RLAS held two workshops, one full day workshop designed for tour company owners and managers, and an evening workshop the next day for staff level participants. In addition to the presentations by agency staff, the workshop included displays from local agencies. The workshops were well supported by Guam Coastal Management Program (GCMP), Guam Department of Agriculture, Guam Environmental Protection Agency, the Guam Visitors Bureau and were very well received.

In 2008, the RLAS in conjunction with the Guam Year of the Reef efforts held a second coral reef protection workshop for tour operators. This workshop was coordinated by the GCMP, the RLAS, and NOAA and was shorter, but included more interactive activities and more examples of reef impacts on Guam. There was no outside coordination or facilitation, invitations were sent by GCMP using existing lists from the 2004 event and the yellow page listings. The shorter format, videos and interactive additions to this workshop were well received. Participants received a booklet on best management practices for reef tour operators, and outreach materials such as a Reef Pledge and table tents on reef etiquette.

More recently, the RLAS decided that it was time to do another workshop and originally expected to hire a company to coordinate logistics, develop an updated operator list, and handle invitations and materials. Due to changes in local capacity, the funding was transferred to UOGML and the scope of the original project was modified to include a study on diver impacts to coral reefs in addition to a recreational use workshop. Professor Laurie Raymundo and her graduate student, Ashton Williams, were in charge of the project. NOAA Fishery Biologist, Val Brown offered to assist with the workshop as she had participated in the 2004 workshop and was a coordinator for the 2008 workshop. UOGML handled all logistics and handouts, while NOAA coordinated the workshop content and facilitated the workshop.

Workshop Content and Materials

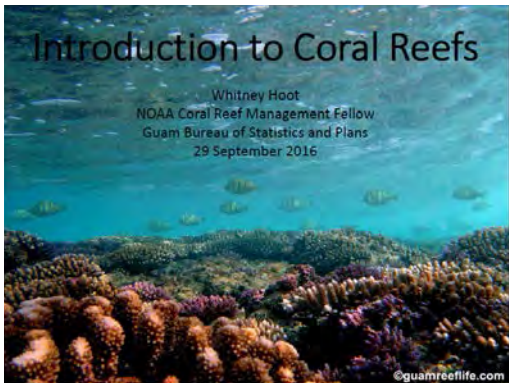
The workshop included two segments. The first segment provided an introduction to coral reefs, an overview of the status of Guam's reefs, and a summary of recent coral bleaching events. The second segment was focused on recreational impacts to coral reefs, programs for reef conservation, and a discussion of best management

programs. We then solicited feedback from participants on the workshop and on coral reef protection from recreational and tourism activities. The workshop was supposed to include an interactive scenario practice, but due to some technical difficulties, that part of the workshop was cut in favor of getting feedback from participants.

A summary of each presentation is provided below.

Presentation 1: Workshop Introduction
Presenter: Val Brown, NOAA Fisheries

This presentation set the stage for the workshop. It provided an overview of Guam's coral reefs and reminded participants that they are limited, valuable, and in trouble from climate change associated coral bleaching and many other threats. Participants were reminded that minimizing tourism and recreational impacts is relatively easy and a way that all water users can help protect coral reefs. The presentation also included the evening's agenda.

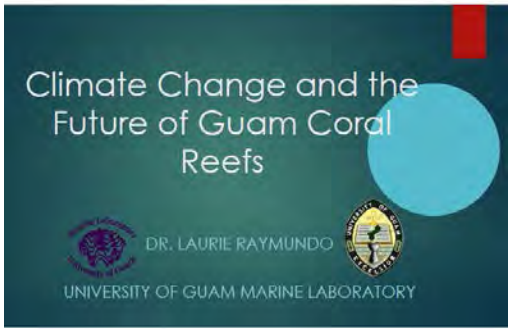


Presentation 2: Introduction to Coral Reefs
Presenter: Whitney Hoot, NOAA Coral Reef Management Fellow at BSP

This presentation provided basic information on coral reef ecology that was necessary for understanding impacts to coral reefs. This included coral biology, coral bleaching, climate change impacts, coral disease and predation. The presentation also emphasized that reefs are resilient and can resist change if given a chance.

Presentation 3: The Status of Guam's Shallow Coral Reefs
Presenter: Dave Burdick, UOGML

This presentation highlighted key threats to Guam's reefs including Guam's high population density in relation to total reef area, crown-of-thorns sea stars (COTS), land based sources of pollution, lack of large herbivores, climate change, and recreational impacts. Photos from reefs around Guam illustrated the range of coral reef condition found on Guam, including areas with only 2% coral cover to areas with much higher coral cover and better condition. This presentation stressed the need to protect remaining coral reef resources.



Presentation 4: Climate Change and the Future of Guam Coral Reefs
Presenter: Dr. Laurie Raymundo, UOGML

This presentation highlighted the climate change impacting Guam's reefs as well as potential future impacts. Specifically it provided data on the bleaching events in 2013, 2014, and 2016, as well as the low tide events linked to El Nino in 2015. Participants were shocked to learn that 85% of taxa surveyed were affected in 2013, but also learned that UOGML and local agencies are working to minimize these impacts.

Presentation 5: Impacts of Recreational Activities and their potential impacts to Guam's coral reefs
Presenter: Val Brown, NOAA Fisheries,
(with slides by Dave Burdick, UOGML)

This presentation discussed impacts from popular tourism and recreational activities such as SCUBA diving, snorkeling, Snuba, and Seawalker as well as reef walking, fish feeding, paddling, and other impacts. It includes pictures and videos of damaging activities and impacts. It also discussed responsible viewing of protected resources such as marine mammals and sea turtles. This presentation included videos of diving impacts, photography impacts, and fish feeding.

Presentation 6: Eyes of the Reef Guam
Presenter: Whitney Hoot, NOAA Coral Reef Management Fellow at BSP

This short presentation introduced participants to the Eyes of the Reef Marianas program. The program is a community based early warning system for reef impacts that any marine user can participate in.

Presentation 7: Tasi Beach Guides
Presenter: Phil Cruz, UOG Center for Island Sustainability

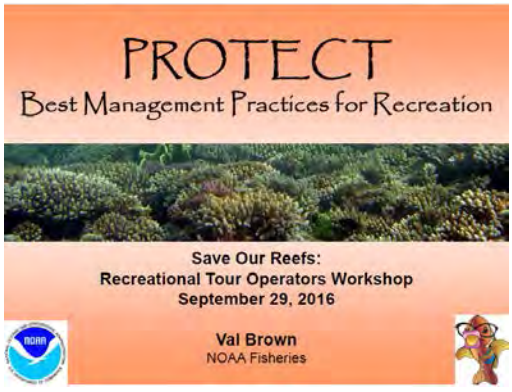
This short presentation described the work that CIS has done to develop the Tasi Beach Guide program in Tumon. The guides provide information to locals and tourists on how to enjoy and protect reefs. (No powerpoint).

Presentation 8: One Ocean Community: Guam Community Coral Reef Monitoring Program
Presenter: Marybelle Quinata, GCCRMP Community Coordinator / NOAA Fisheries / TBG

This short presentation introduced participants to the GCCRMP including coral reef monitoring, the Adopt-a-Reef Program, Human-Use Monitoring and Science Sunday. It highlighted ways that businesses have supported the program and how to get involved.

Presentation 9: Best Management Practices
Presenter: Val Brown, NOAA Fisheries

This presentation provides examples of tools and methods that can be used to minimize impacts to reef during marine tour activities. Focus was on role model behavior and using new underwater briefing cards provided in workshop materials to communicate proper behavior, and completing the self-assessment checklist included in the materials to identify ways to reduce impacts.



Interactive Activity: Scenario Practice
Facilitator: Val Brown, NOAA Fisheries

The workshop was designed to include a thirty minute segment where participants could work in small groups to develop solutions for common impact scenarios. We were not able to include this during the workshop due to technical difficulties and resulting time constraints. However, the description of the activity is included here and scenarios and hints are provided in the appendix.

This activity is designed to help participants explore best management practices and options for common recreational and tourism impacts to reefs and protected resources. Groups read an assigned scenario and discuss different ways to address the issue or issues included in the scenario. Examples include tourists trying to ride marine mammals, photographers breaking coral, and boat operators anchoring on coral. The group is given approximately 15 minutes to discuss their scenario and response. After 15 minute, each group (or representative) reports out to the rest of the room. Participants may elect to enact a role play of their scenario and solution or simply read their scenario and the action they would take. Role playing is recommended as it allows groups to be more creative and inserts some levity into the report outs. The activity facilitator leads discussion on each scenario to highlight potential impacts, good approaches, and other possible solutions. Approaches and BMPs used in the scenarios should be listed on flip charts. If time allows, additional scenarios could be reviewed by each group.

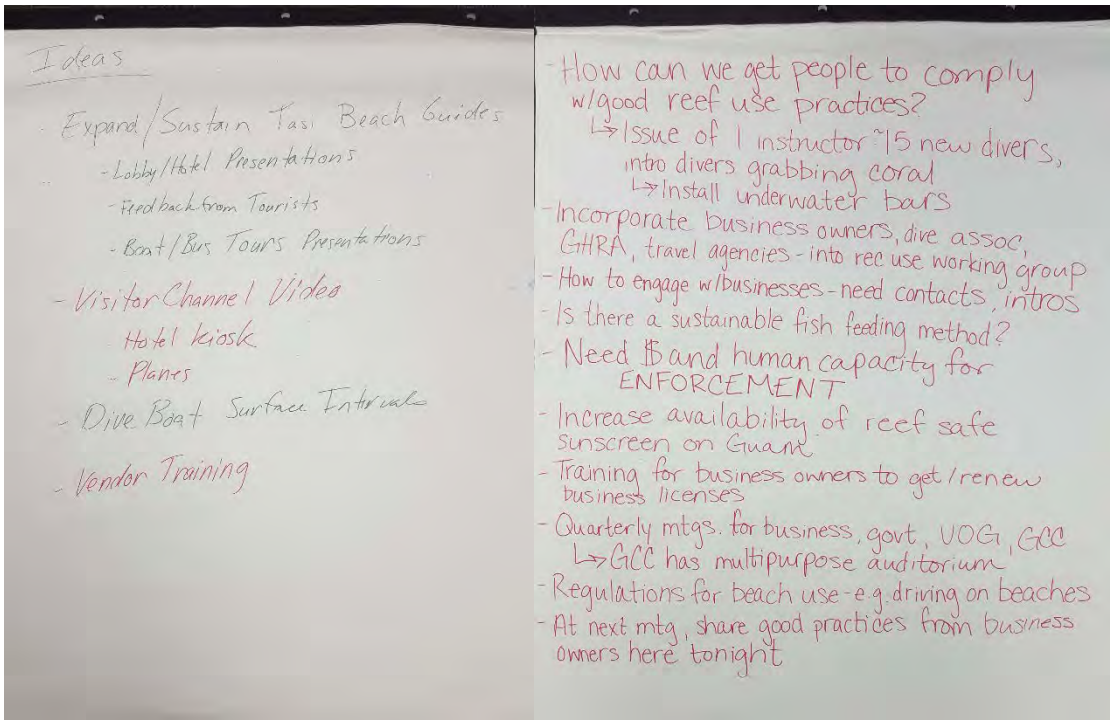
Presentation 10: Summary and Conclusion
Facilitator: Val Brown, NOAA Fisheries

The final segment was a summarization of the workshop, highlighting the need to protect reefs and the tools that participants can use to do so. Participants were encouraged to provide feedback and share ideas for reducing impacts to Guam's marine resources. Their comments were recorded on flipcharts.

Comments included:

- Hold this training more regularly, but make it shorter (2 hours was suggested)
- Make the training more accessible, suggestion to hold it at GCC in association with tourism classes and trainings
- Participants really liked the Tasi Beach Guide program and suggested that it be expanded to include presentations in hotel lobbies or beach entrances, get more feedback from tourists on marine resources, and provide tours on boat / bus tours.
- Reef Etiquette videos were strongly recommended to be played on visitor channel, on incoming planes, and in hotel kiosks.
- Using dive boat surface intervals for educational / conservation presentations, particularly for tourists. This could be a way to both improve reef etiquette and improve the quality of the tour by helping guests appreciate what they are seeing more.
- Establish regular training programs for vendors. The last time this workshop was held was 2008 – participants felt that was much too long.
- Dive operators recommended adding facilities underwater to assist dive guides with beginning divers, for example underwater platforms with bars for divers to hold on to or structures / statues to take pictures with and look at. This might divert beginner divers from more sensitive resources
- Find ways to incorporate more business owners into the RLAS strategy working group.

- Engage more with businesses.
- Hold quarterly meetings with business, government, UOG, GCC etc. on reef status and BMPs / issues / successes (maybe held at GCC)
- Identify sustainable or reef friendly fish feeding options.
- Increase funding and human capacity for enforcement
- Increase availability of reef safe sunscreen
- Require training for business owners to get / renew business licenses for marine tour operations
- Enforce regulations for marine resources or develop new ones. (Driving on Beach was particularly mentioned).
- Share good practices from local businesses, particularly the ones that came to the training.



Handouts

This workshop used some of the materials used in the 2008 workshop, particularly the booklet entitled "*A PRACTICAL GUIDE TO GOOD PRACTICE: Managing Environmental Impacts in the Marine Recreation Sector*" developed by the Center for Environmental Leadership in Business, the Tour Operators' Initiative for Sustainable Tourism Development and the Coral Reef Alliance (2004). And the associated self-assessment checklist. These booklets provide good information and resources for tour operators seeking to reduce impacts.

In addition, UOGML contacted the Green Fins network (http://www.greenfins.net/en) to request permission to use their materials in our training. The Green Fins program started as an initiative of the United Nations Environment Program in 2004 and has since expanded to include a number of countries in Asia. While Green Fins has not expanded to the Marianas, it has developed many useful tools, such as multi-lingual reef etiquette materials that may help local tour operators communicate with and educate

their customers. UOGML modified the dive briefing cards to create waterproof briefing guides and communication tools for dive instructors and snorkeling guides. These cards include reef etiquette reminders in English, Japanese, Korean, and Chinese. A set of these briefing guides were provided to each participant as well as waterproof posters in English and Japanese illustrating the full set of Green Fins icons. These materials as well as reminder stickers were packaged in a reusable bag with the Green Fins logo to facilitate their transport and to provide visual reminders to "Save Our Reefs". Please see the appendix for copies of these materials.

Participants were also provided with NOAA Pacific Island Regional Office materials on spinner dolphin viewing guidelines and habits to promote MMPA compliant viewing for dolphin watching tours and other interactions with marine mammals.

Conclusions and Recommendations

The workshop did not attract as many participants as the organizers had hoped for. Invitations were sent out to known marine tourism operators via email and posted on outreach facebook sites. Due to a lack of capacity the team was not able to hand out invitations at all of the dive shops and dive sites as was done in the past. Further, the workshop overlapped with events associated with the Pacific Hotel and Restaurant Expo. In the future, we should check with industry contacts to avoid conflicts with other

events, or work with the Guam Hotel and Restaurant Association (GHRA) to incorporate the training into larger tourism events. Paid advertisements in the newspaper and hand delivered invitations would also increase participation.

The materials produced for the workshop were shared with representatives of GHRA and were well received. Sets will be distributed by GHRA to all of the hotels and we will be following up with additional information and resources and possibly a shorter, more focused training in the first quarter of fiscal year 2017.

Overall this workshop was well received by participants and they strongly recommended that the workshop be repeated more frequently. They did suggest that the workshop be condensed to take only about two hours and to definitely include the scenarios and feedback sessions. Industry participants recommended that the presenters significantly reduce the amount of scientific information at the beginning and focus more on recreational impacts and tourism management practices that they could implement. All of the industry participants said that they would recommend the workshop to others and will attend again if we hold sessions in the future.

Appendices:

Appendix A: Handouts
Appendix B: Sign In Sheet
Appendix C: Presentation Slides
Appendix D: Scenarios

To help protect Guam's reefs, we ask that while you are **DIVING** with us, please...

PRACTICE **ADVANCED BUOYANCY** AND **FINNING TECHNIQUES** TO STAY CLEAR OF MARINE LIFE.

DO NOT STEP ON CORAL

Watch your feet and fins at all times. Most damaging contacts to the reef come from your fins.

Corals are very fragile and take a long time to grow.

DO NOT STIR THE SEDIMENT

If you are not careful, your fins can stir up the sediment and debris, upsetting sandy habitats and covering nearby corals.

To help protect Guam's reefs, we ask that while you are on our BOAT, please...

NO LITTERING

Marine debris can kill turtles, birds and coral. Show guests where they can dispose of trash.

NO FISH FEEDING

Food thrown overboard attracts fish away from their natural food source. This upsets the food web.

NO COLLECTING MARINE LIFE

If it is found underwater, it should stay underwater. This activity is often illegal and can leave species homeless.

WEAR A LIFE JACKET WHEN SNORKELING

Wearing a life jacket helps you avoid standing on or kicking shallow corals that will take many years to recover.

To help protect Guam's reefs, we ask that while you are **DIVING** with us, please...

PRACTICE **ADVANCED BUOYANCY** AND **FINNING TECHNIQUES** TO STAY CLEAR OF MARINE LIFE.

DO NOT CHASE OR TOUCH MARINE LIFE

This can cause great stress to any animal. This can also transmit diseases or remove protective coatings on fish, invertebrates and other species.

Look but never touch; try not to get too close.

DO NOT WEAR GLOVES

In some dive sites it's illegal to use gloves while diving.

Wearing gloves gives you a false sense of protection and encourages you to hold on to things, like coral, underwater.


GREEN FINS
Respect marine life & shoot photos without disturbing the environment
Support conservation & champion Green Fins
Ensure all equipment is secured & do not drag over reefs
Practice buoyancy control & photography skills
Practice advanced finning techniques
Only touch rock or dead coral if necessary
Avoid stirring up sediment by keeping your distance

GREEN FINS

No stepping on coral

No stirring the sediment

No touching or chasing marine life

Do not collect dead or alive marine life

No feeding fish

No gloves

No littering

Wear a life jacket when snorkelling

GREEN FINS

珊瑚の上に立たない。

海底の砂をかき回さない。

生き物を触ったり追いかけたりしない。

生きている、死んでいるに拘わらず、生き物を採集しない。

魚に餌をやらない。

手袋をしない。

ゴミを捨てない。

救命胴衣を着用する。
(スノーケルの際)

GREEN FINS

不可踩踏珊瑚

不可搅拌泥沙

不可触碰或追赶海洋生物

不可收集活或死的海洋生物

不可喂鱼

不可戴手套

不可乱丢垃圾

浮潜时请穿救生衣

GREEN FINS

산호초 위에 서지 마세요

침전물을 휘젓지 마세요

해양생물을 만지거나 뒤쫓지 마세요

죽거나 살아있는 해양동식물을 수집하지 마세요

물고기에게 먹이 주지 마세요

장갑 착용하지 마세요

쓰레기 버리지 마세요

구명조끼를 착용하세요 (스노컬링 시)

No stepping on coral

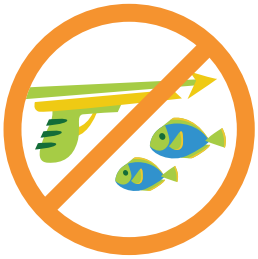
No stirring the sediment

No touching or chasing marine life

No gloves

No feeding fish

No littering



No spearfishing

Do not support shark finning

Don't buy souvenirs of coral and marine life

Do not collect dead or alive marine life

Do not anchor on coral reefs

Use mooring buoys

Wear a life jacket when snorkelling

Report environmental violations

Join in conservation projects

JAPAN

珊瑚の上に立たない。

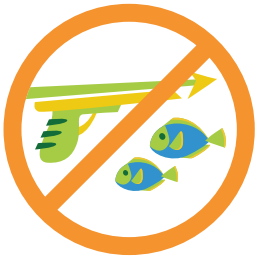
海底の砂をかき回さない。

生き物を触ったり追いかけたりしない。

手袋をしない。

魚に餌をやらない。

ゴミを捨てない。



水中銃の使用を禁止する。

ヒレ目当てのサメ漁を禁止する。

珊瑚や海洋生物のお土産を買わない。

生きている、死んでいるに拘わらず、生き物を採集しない。

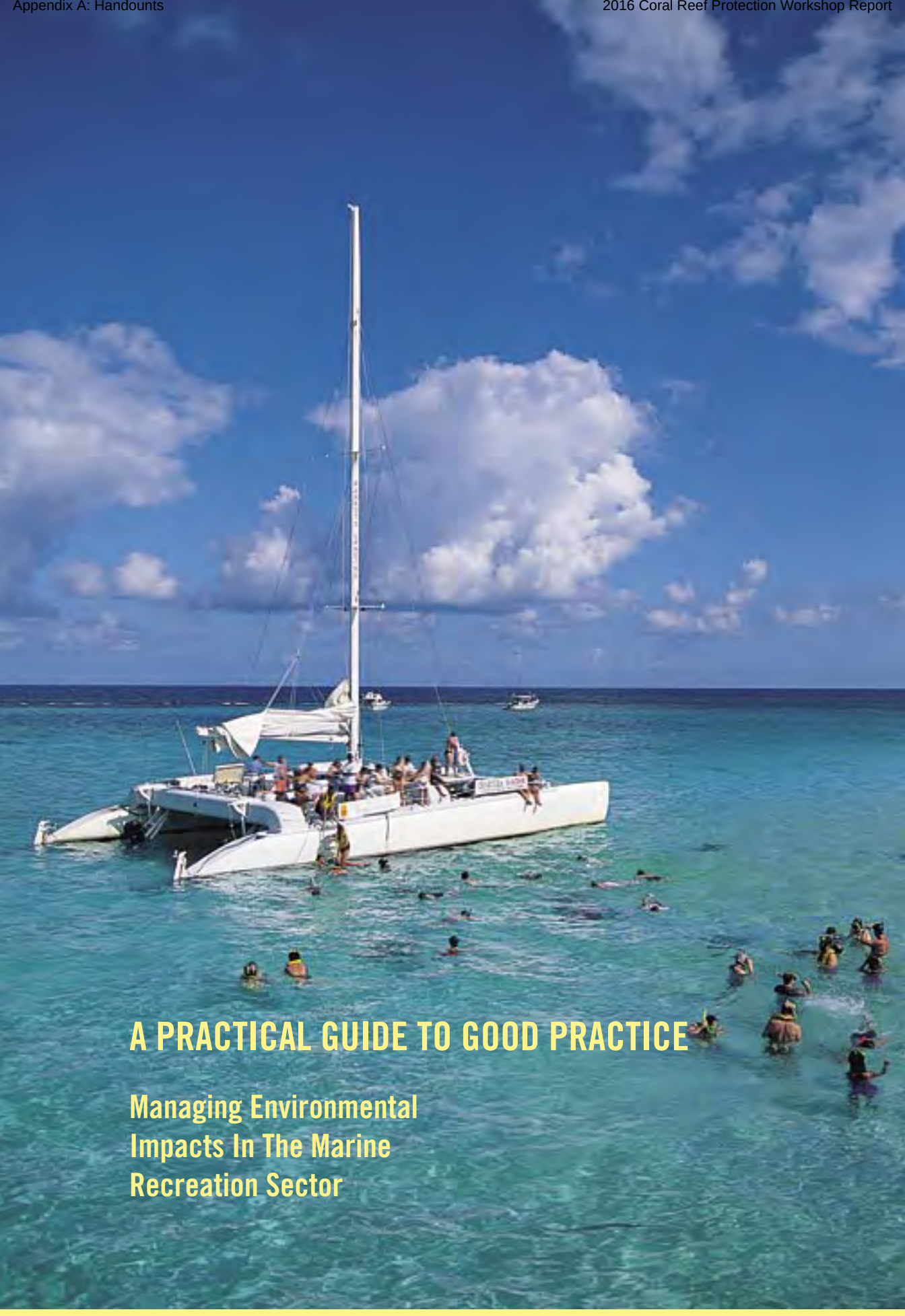
珊瑚礁にアンカーを打たない。

係留ブイを使用する。

救命胴衣を着用する。（スノーケルの際）

環境を破壊する行為は、通報して下さい。

環境のためにボランティアをする。



A PRACTICAL GUIDE TO GOOD PRACTICE

Managing Environmental Impacts In The Marine Recreation Sector

Available online at: http://icran.org/pdf/MarineRecreationGuideENG.pdf

THE CENTER FOR ENVIRONMENTAL LEADERSHIP IN BUSINESS

CORAL® The Coral Reef Alliance

TOUR OPERATORS INITIATIVE FOR SUSTAINABLE TOURISM DEVELOPMENT

SELF-ASSESSMENT CHECKLIST

Managing Environmental Impacts In The Marine Recreation Sector

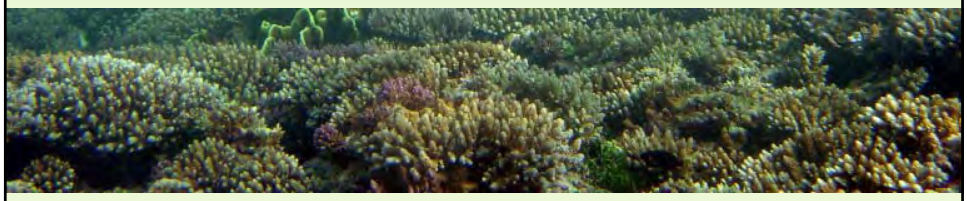
Available online at : http://www.reefresilience.org/pdf/Marine_Checklist.pdf

THE CENTER FOR ENVIRONMENTAL LEADERSHIP IN BUSINESS

CORAL® THE CORAL REEF ALLIANCE

TOUR OPERATORS INITIATIVE FOR SUSTAINABLE TOURISM DEVELOPMENT

Save Our Reefs:
Reef Safe Tour Operator Workshop



September 29, 2016

Val Brown
NOAA Fisheries

Featuring the Photos of:
David Burdick and Tom Schils

Introduction to Guam's coral reefs

- **Several different types of reefs on Guam: fringing reefs, barrier reefs, patch reefs, submerged reefs, offshore banks**
- **108 km² (42 mi²) of shallow reef area within 0-3 miles; 110 km² between 3-200 miles**
- **Over 5100 marine species**
- **Lies relatively close to Indo-Pacific center of marine biodiversity**
- **Possesses one of most species-rich marine ecosystems of any U.S. jurisdiction**

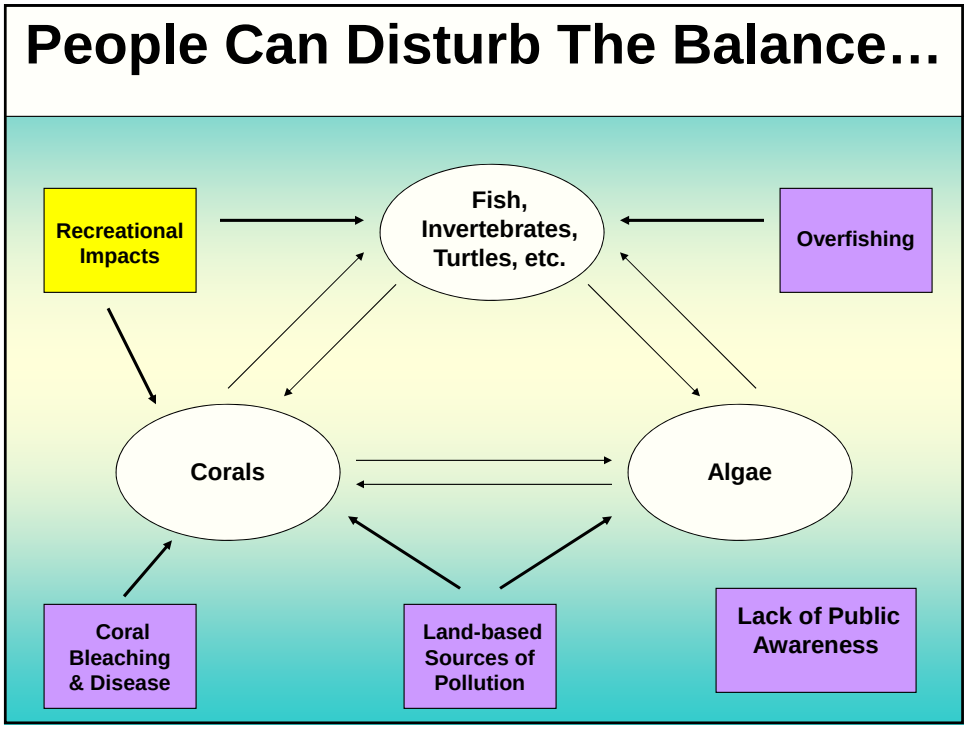
Quickbird satellite imagery provided by DigitalGlobe

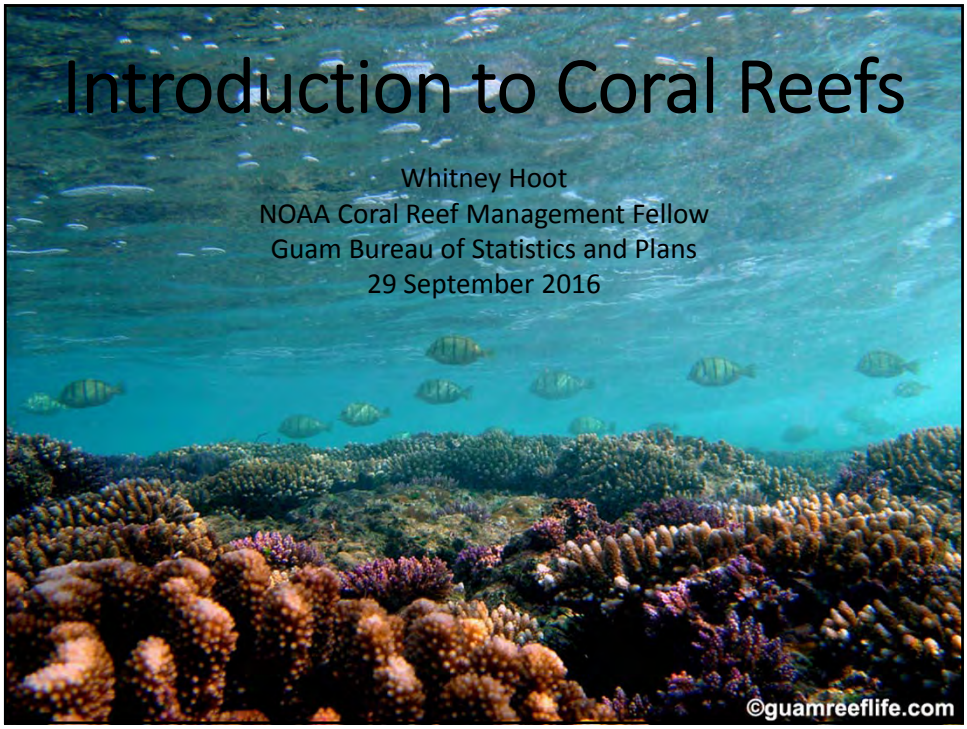
Coral Reefs Are Complex

Coral Reefs Are In Trouble

Tonight's Agenda

- The Status of Guam's Reefs
- What is Coral Bleaching?
- Coral Bleaching Impacts 2013-2016
- Recreational Impacts
- Programs for Reef Conservation
- Best Practices
- Scenario Practice
- Conclusions and Feedback


People Can Disturb The Balance…
Recreational Impacts
Fish, Invertebrates, Turtles, etc.
Overfishing
Corals
Algae
Coral Bleaching & Disease
Land-based Sources of Pollution
Lack of Public Awareness


Introduction to Coral Reefs
Whitney Hoot
NOAA Coral Reef Management Fellow
Guam Bureau of Statistics and Plans
29 September 2016
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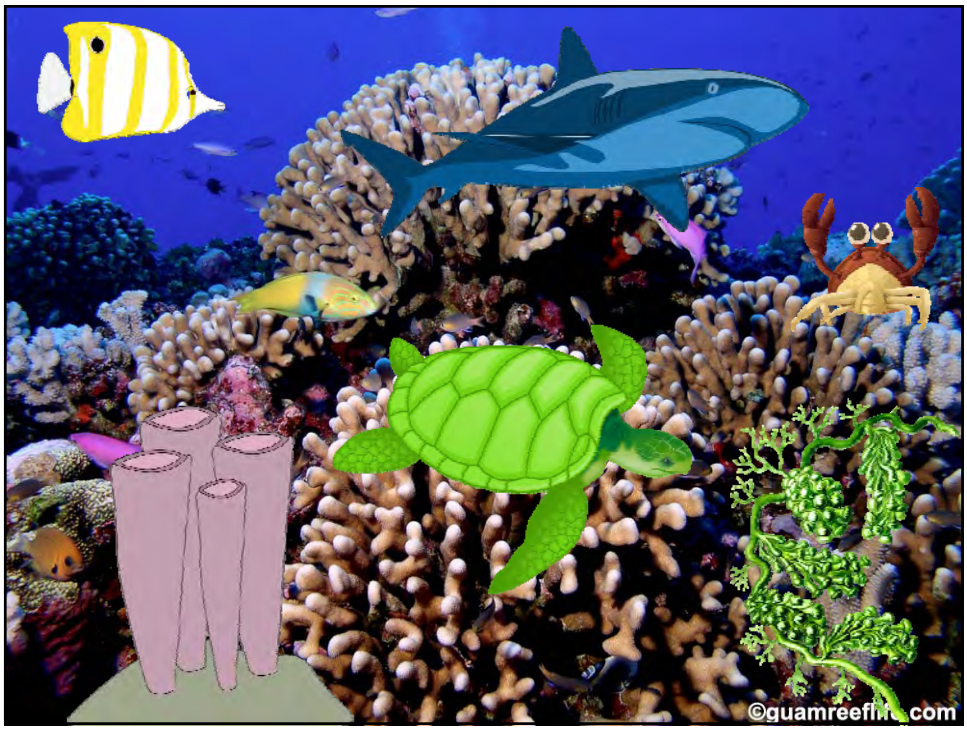
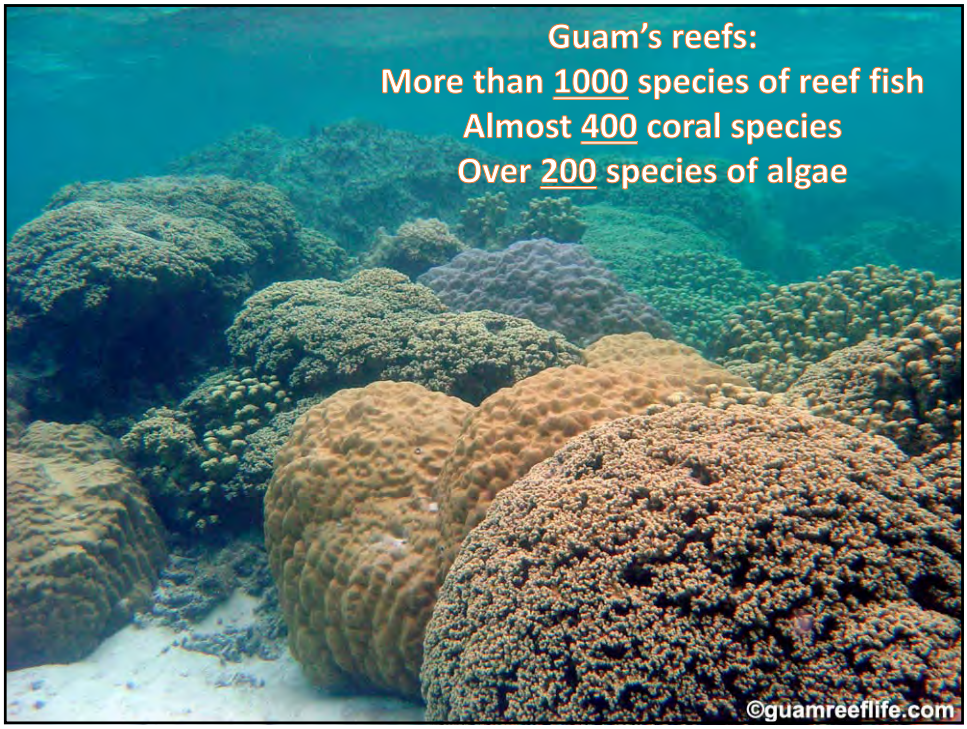
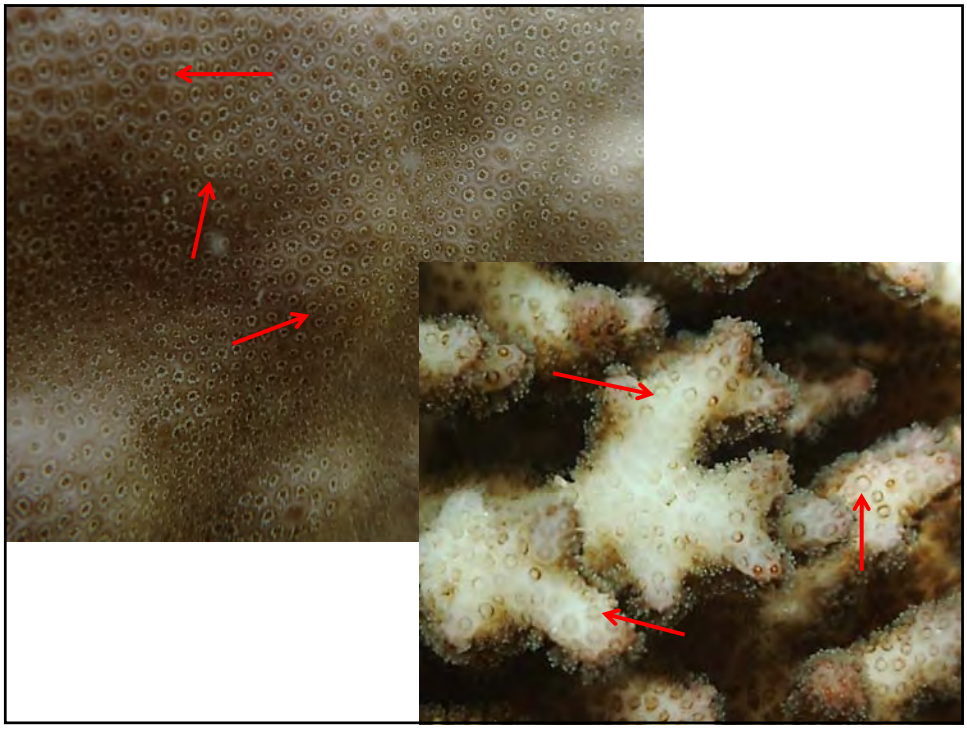
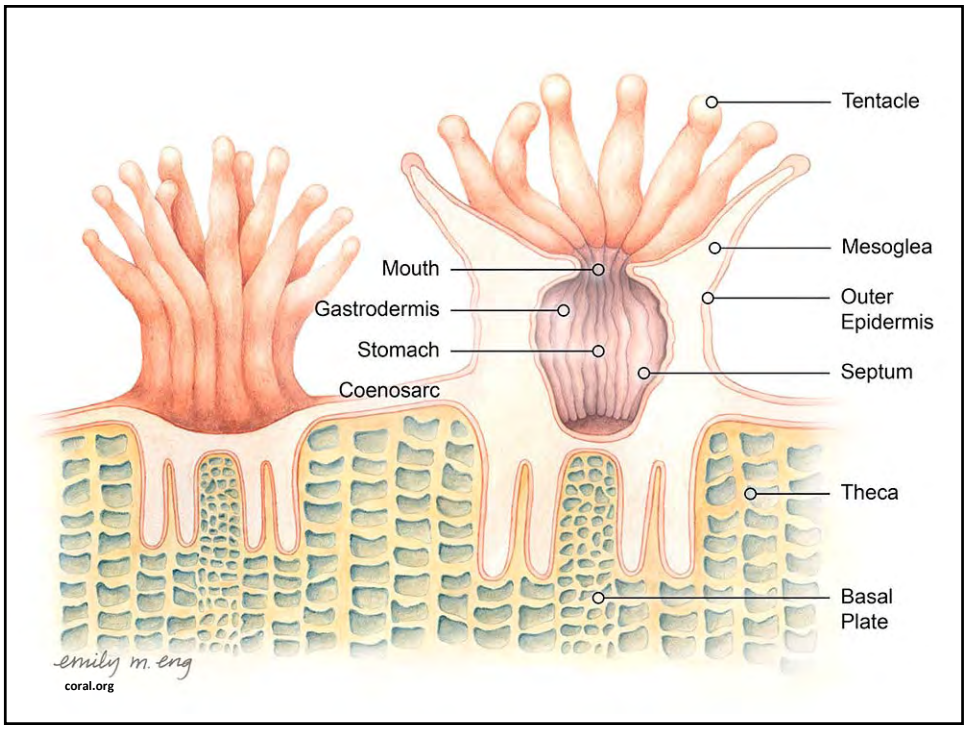
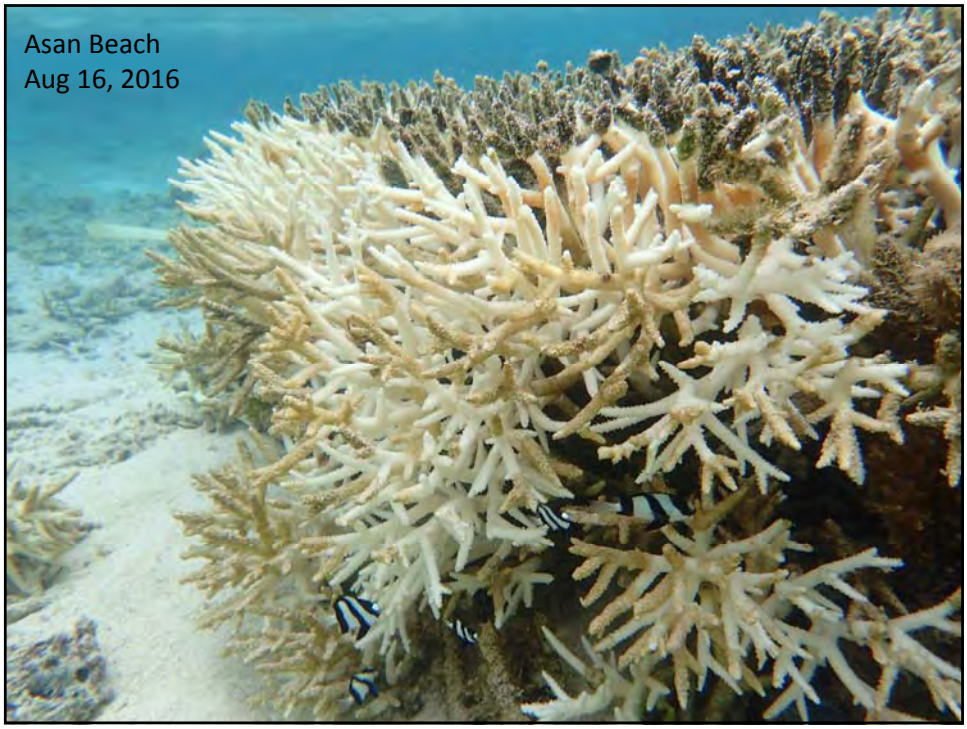

©guamreeflife.com

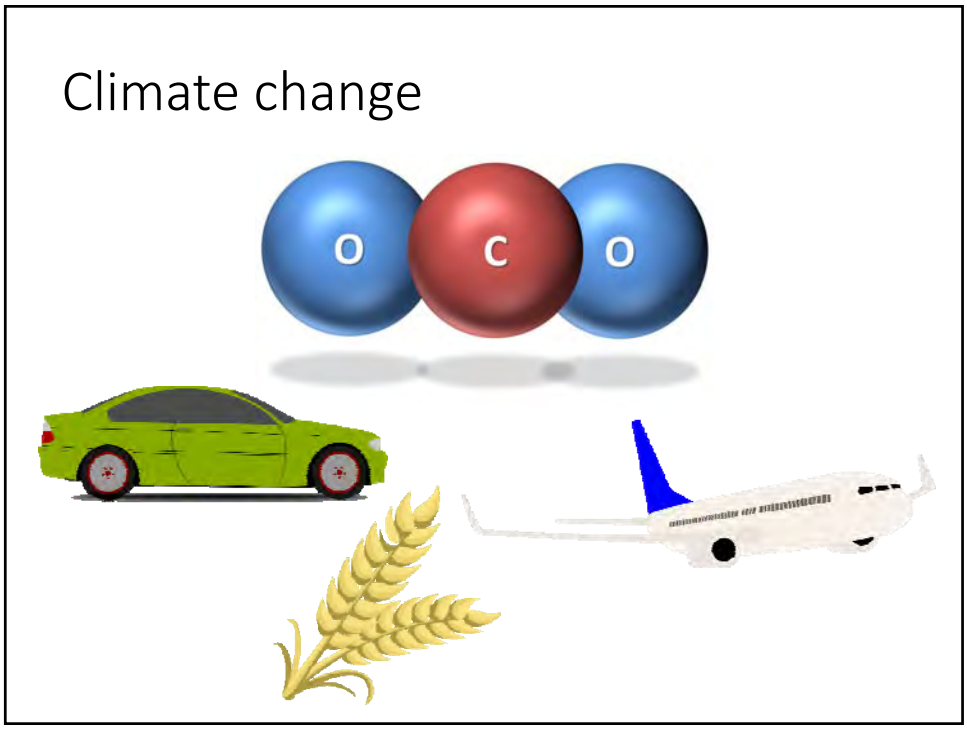

Guam's reefs:
More than 1000 species of reef fish
Almost 400 coral species
Over 200 species of algae
©guamreeflife.com




Tentacle
Mesoglea
Mouth
Outer Epidermis
Gastrodermis
Stomach
Septum
Coenosarc
Theca
Basal Plate
emily m. eng
coral.org

Zooxanthellae + Coral = Symbiosis


Asan Beach
Aug 16, 2016


Climate change
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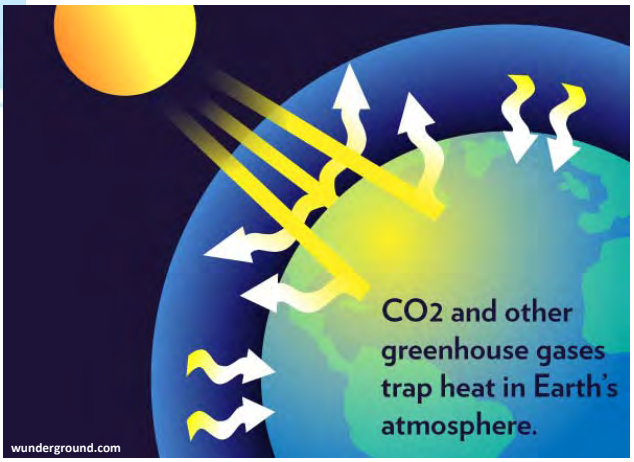
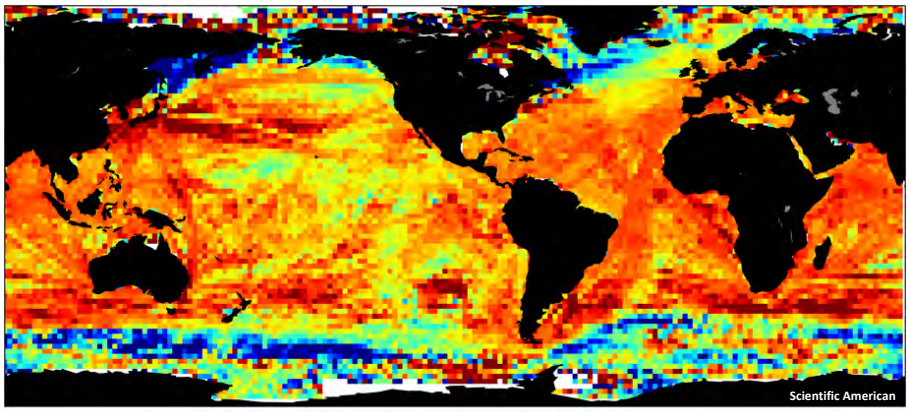
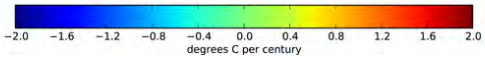
Greenhouse effect



Warming oceans



Changes in sea surface temperature since 1900



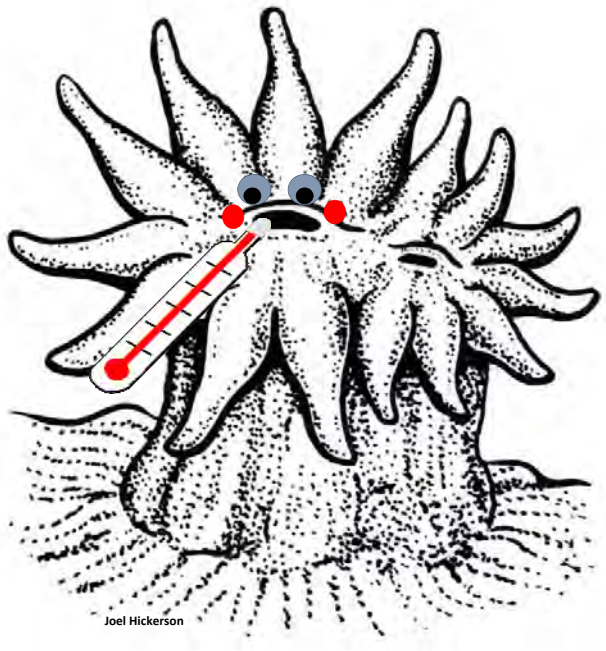
Bleaching

Queensland University of Technology

Asan Beach
Aug 3, 2016

Agat
July 31, 2016

Piti
Aug 10, 2016



Crown of thorns sea star

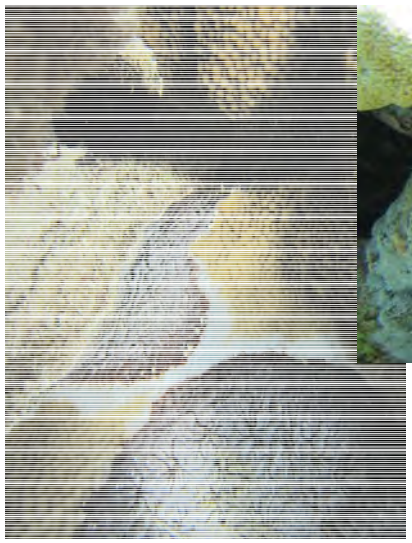
Drupella snail

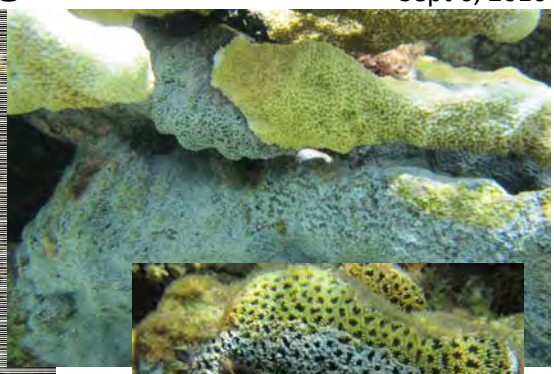
Ritidian
Sept 6, 2016

Pago Bay
July 22, 2016

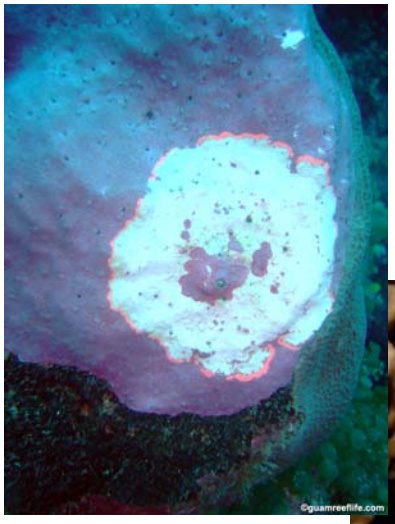
Terpios sponge

Ritidian
Sept 6, 2016

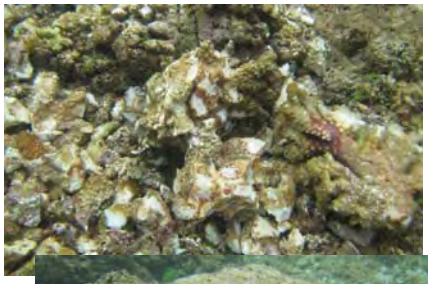




Coral diseases



Human impacts

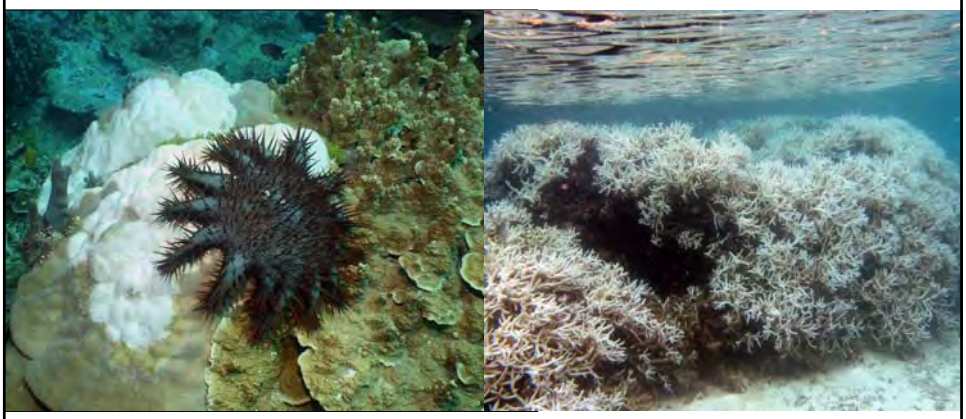


Agat
Sept 8, 2016

RESILIENCE

"the ability of a system, like a coral reef, to resist change and recover from an impact"

The Status of Guam's Shallow Coral Reefs:



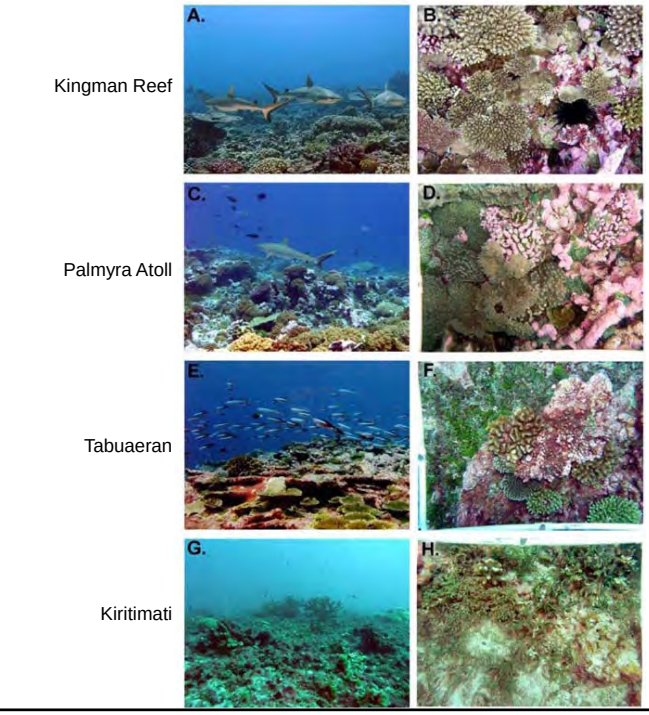
36th U.S. Coral Reef Task Force Meeting

Dave Burdick, Research Associate
University of Guam Marine Lab

Nearshore reef types and area

- Fringing, barrier, patch
- Reef area:
  - Guam: 105 km^2 (41 mi^2)*
  - CNMI: 203 km^2 (78 mi^2)*
    - Saipan, Tinian, Rota: 105 km^2 (41 mi^2)**
  - Palau: ~1500 km^2 (580 mi^2)

**NOAA NCCOS-CCMABB (2012), to ~30 m depth
**NOAA PIFSC-CREP (2012), to ~30 m depth



Kingman Reef

Pristine

Population: 0
Pop. Dens.:**0 ind/km reef**

Palmyra Atoll

Good

Population: 20
Pop. Dens.:**0.5 ind/km reef**

Tabuaeran

Fair

Population: 2539
Pop. Dens.:**62.2 ind/km reef**

Kiritimati

Poor

Population: 5115
Pop. Dens.:**108.9 ind/km reef**
Commercial fishing

Figure from Sandin et al. (2008)

36th U.S. Coral Reef Task Force Meeting — The Status of Guam's Coral Reefs

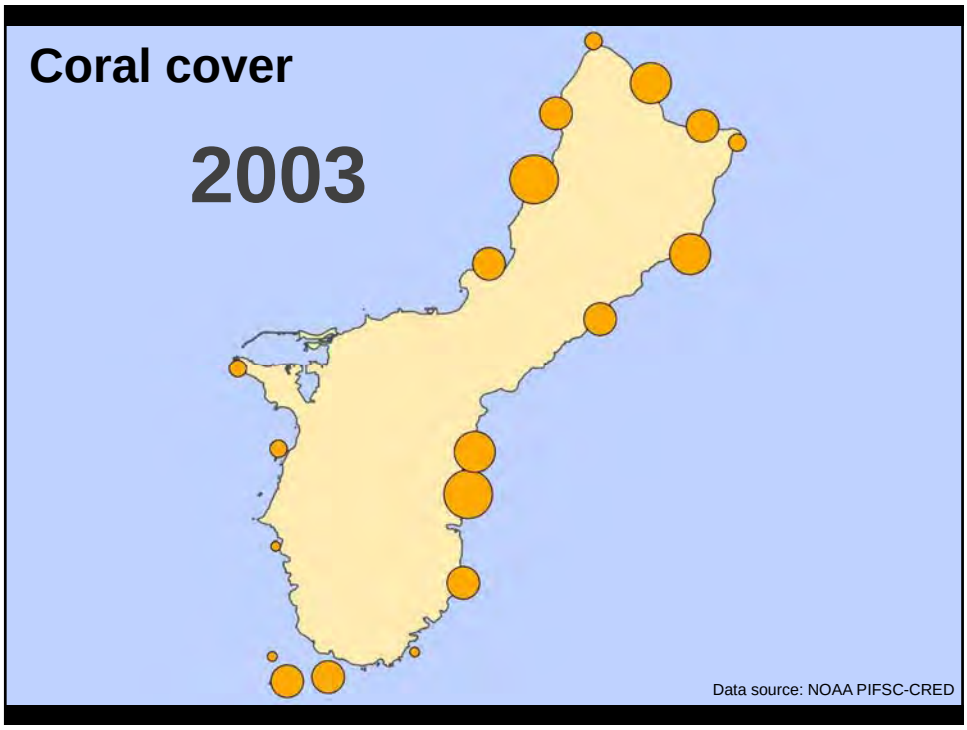
- Population: ~160,000
- Pop. Dens.: **~730 ind/km reef**
- **7x density of "Poor" scenario**

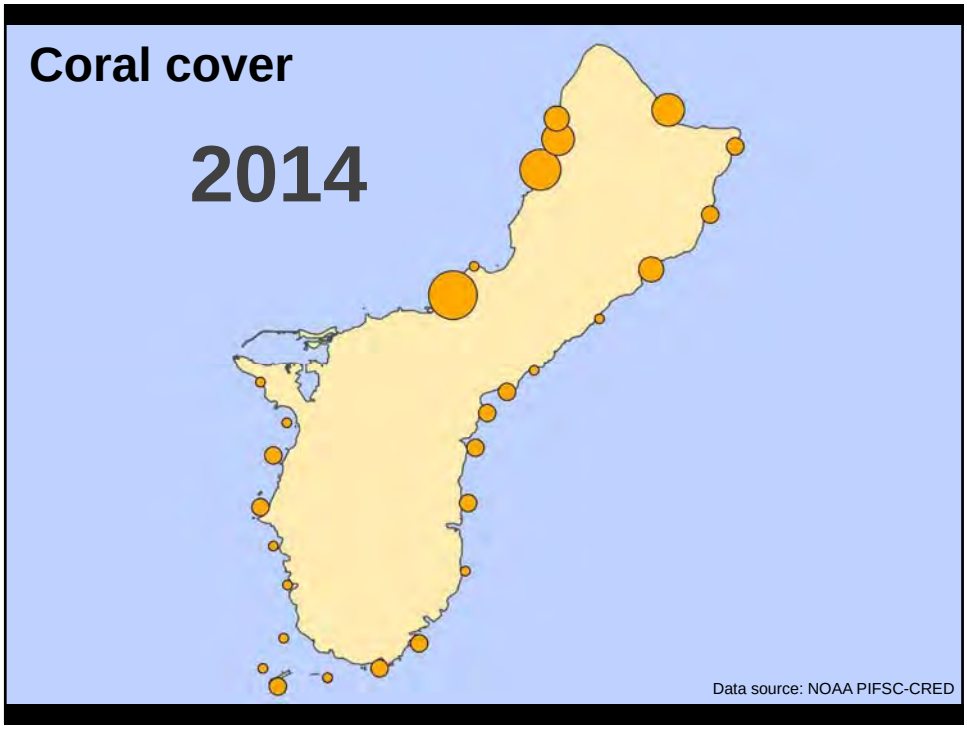
+ >1.3 million tourists/yr

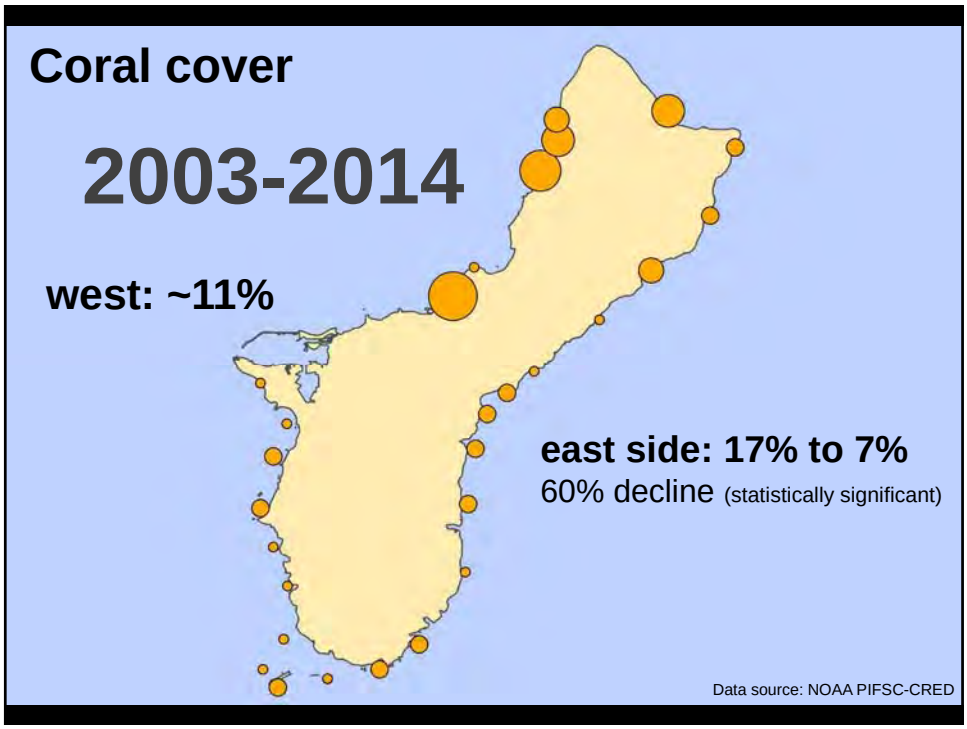
Status of Guam's Reefs: Seaward slope

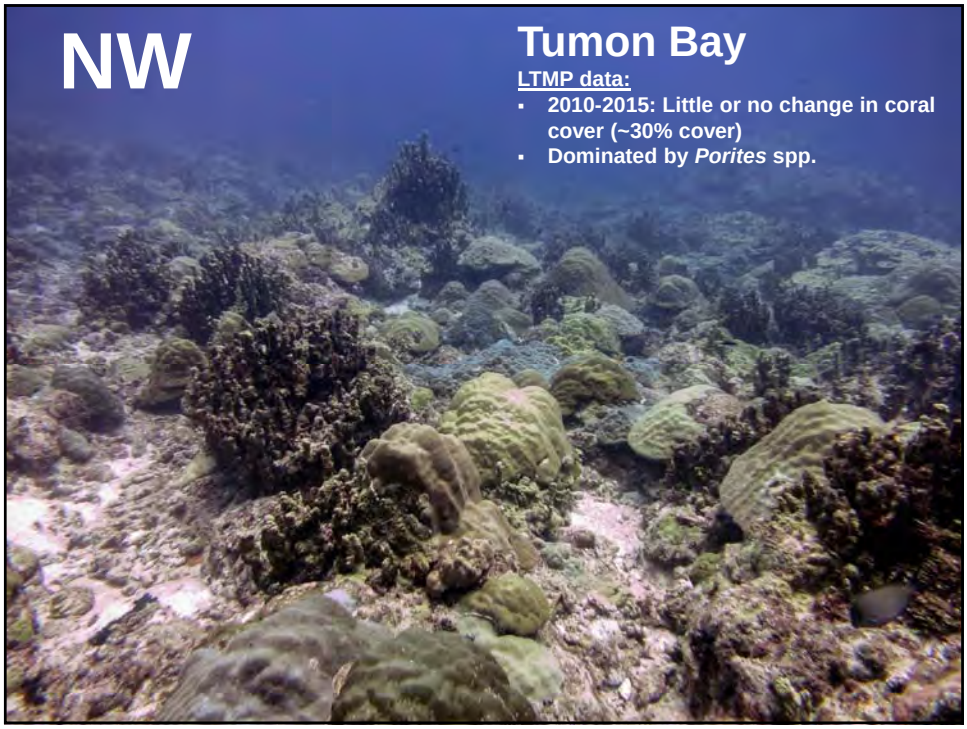
- An estimated **80% decline** in amount of living coral along seaward slope since 1960s
  - 1960s-1990s: ~50% to ~25%*
  - 2003-2014: 16% to 10%**
    - but change not statistically significant at island-scale
    - ~10% cover since 2009

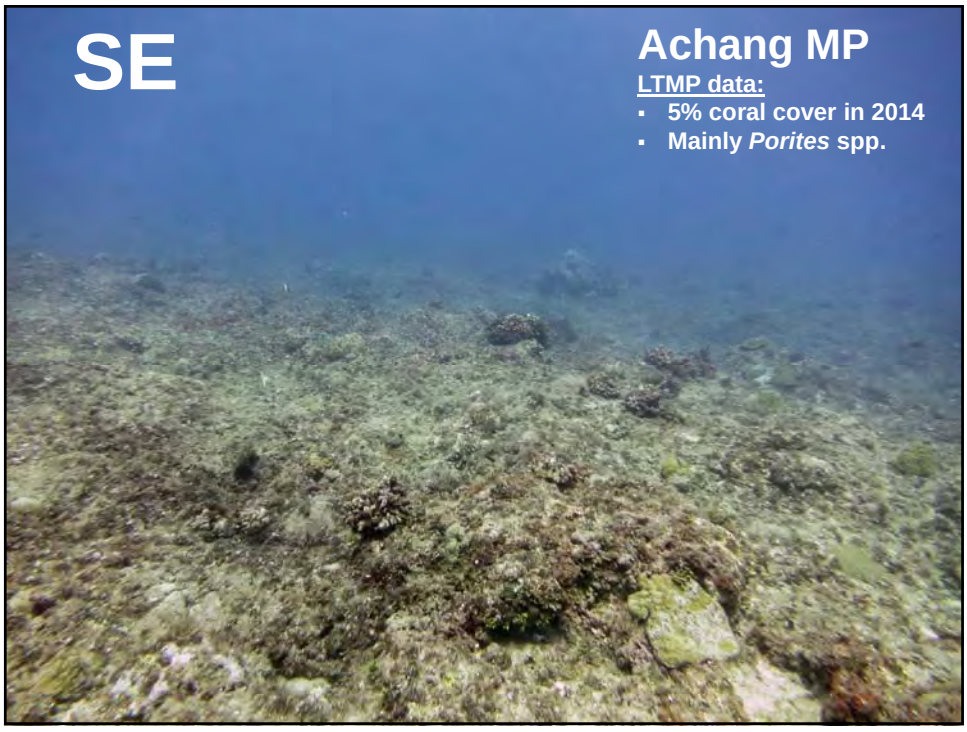
*Status of the Coral Reef Ecosystems of Guam: 2008
**NOAA PIFSC-CREP

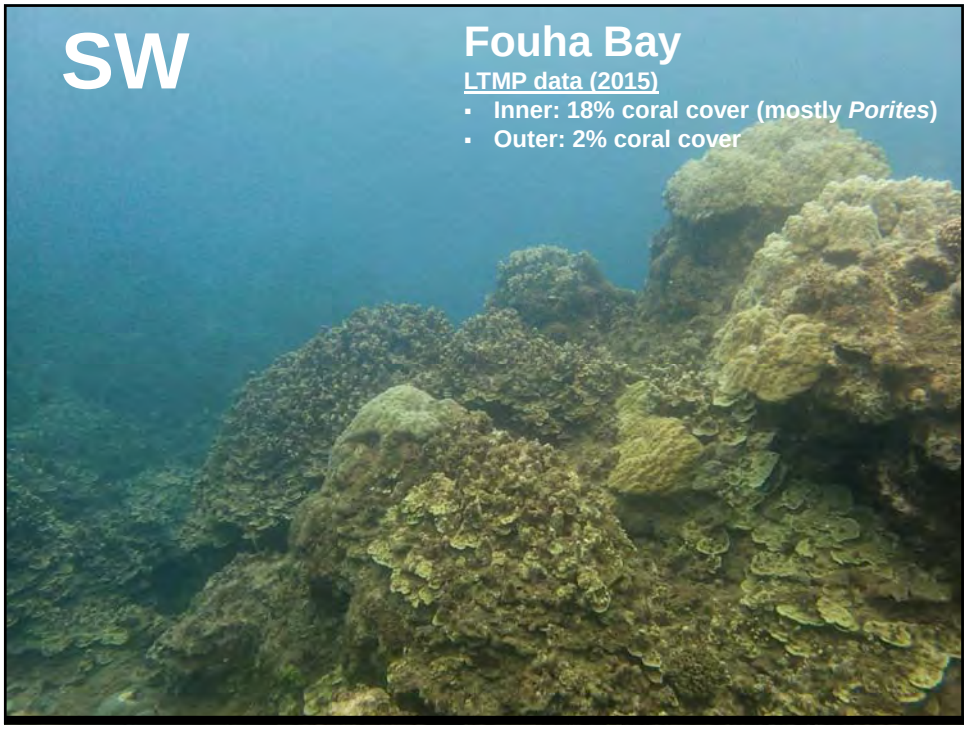


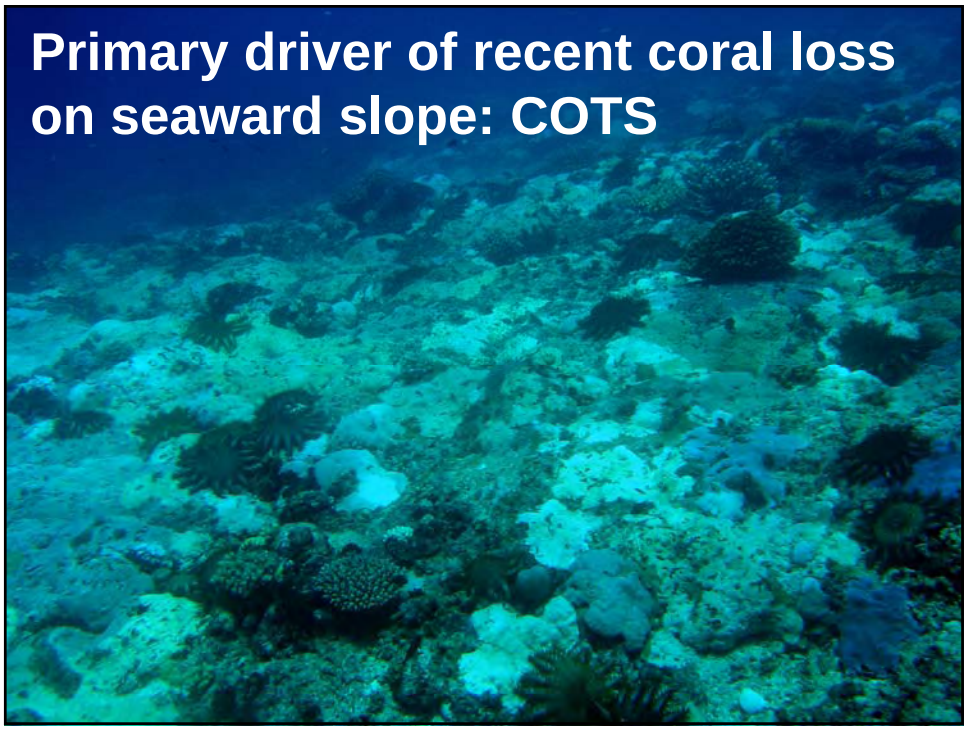

Coral cover
2014
Data source: NOAA PIFSC-CRED

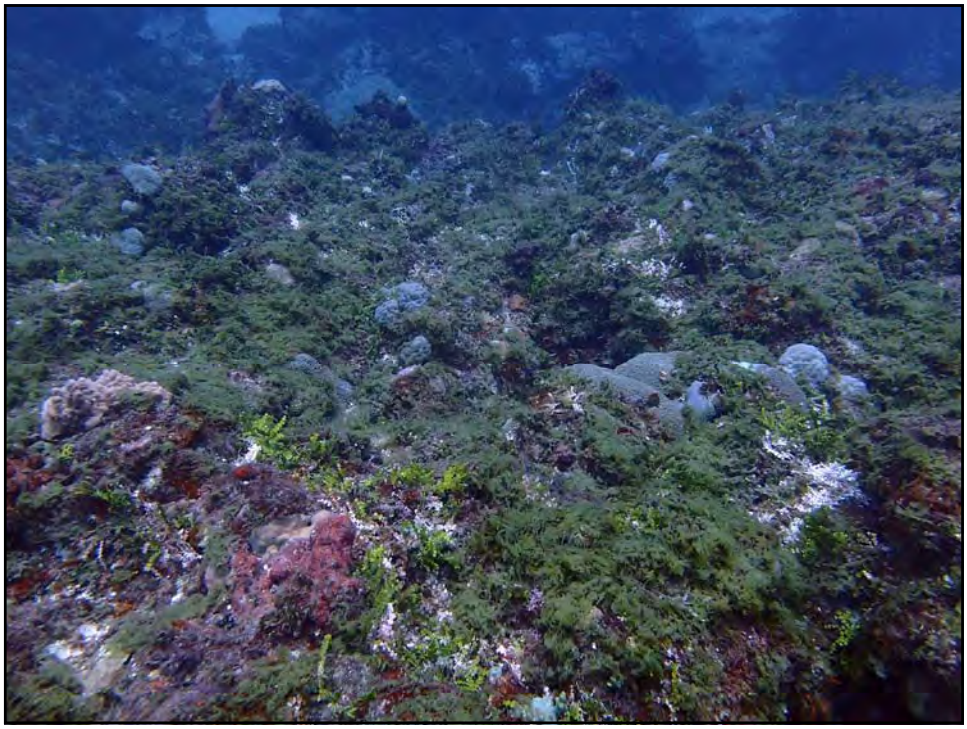

Coral cover
2003-2014
west: ~11%
east side: 17% to 7%
60% decline (statistically significant)
Data source: NOAA PIFSC-CRED


NW
Tumon Bay
LTMP data:
▪ 2010-2015: Little or no change in coral cover (~30% cover)
▪ Dominated by *Porites* spp.


SE
Achang MP
LTMP data:
▪ 5% coral cover in 2014
▪ Mainly *Porites* spp.


SW
Fouha Bay
LTMP data (2015)
Inner: 18% coral cover (mostly *Porites*)
Outer: 2% coral cover


Primary driver of recent coral loss on seaward slope: COTS

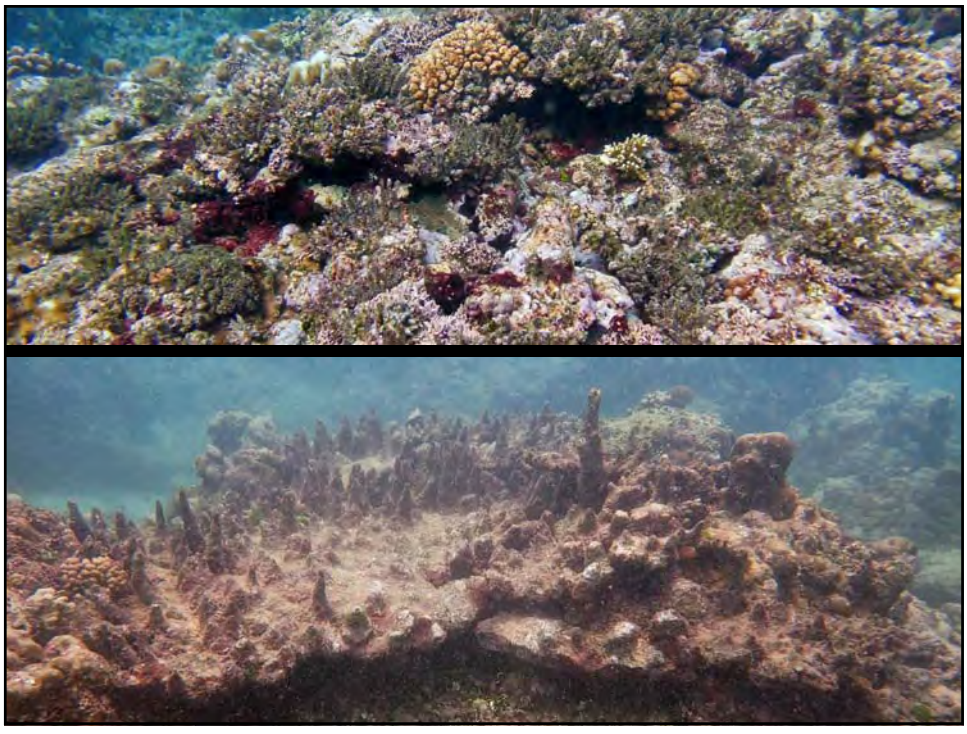


COTS outbreaks: 2003-2014

NOAA CREP towed-diver surveys

Status of Guam's Reefs: Reef front

- 2013: Avg of ~25% coral cover island-wide
- Post-2013/2014 bleaching events?
  - At least 20% coral lost (still to be confirmed)

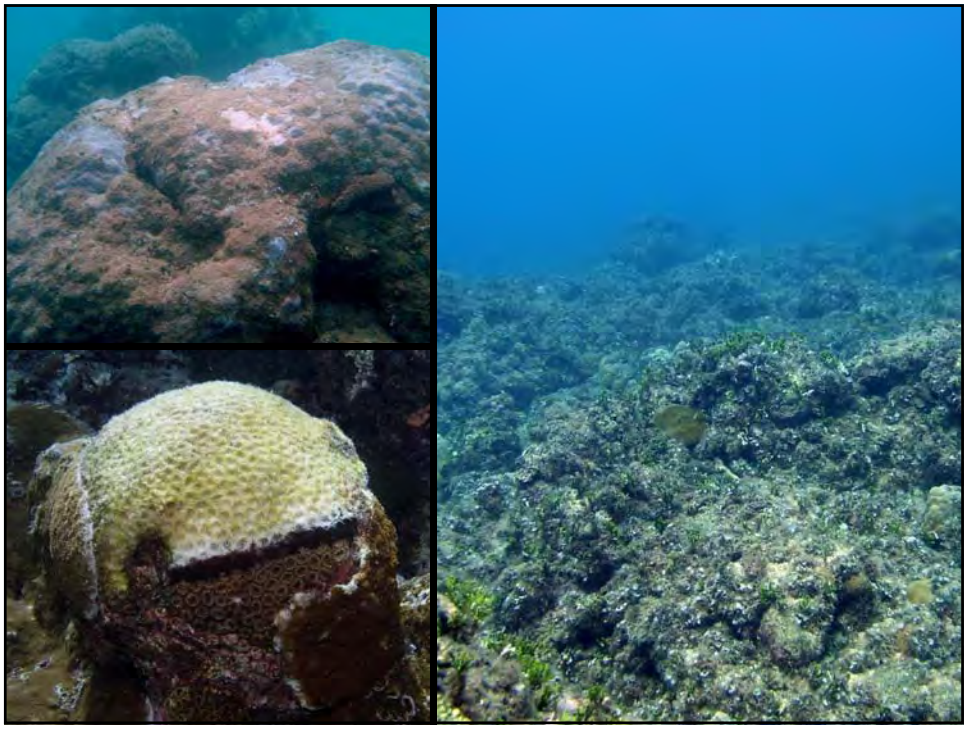


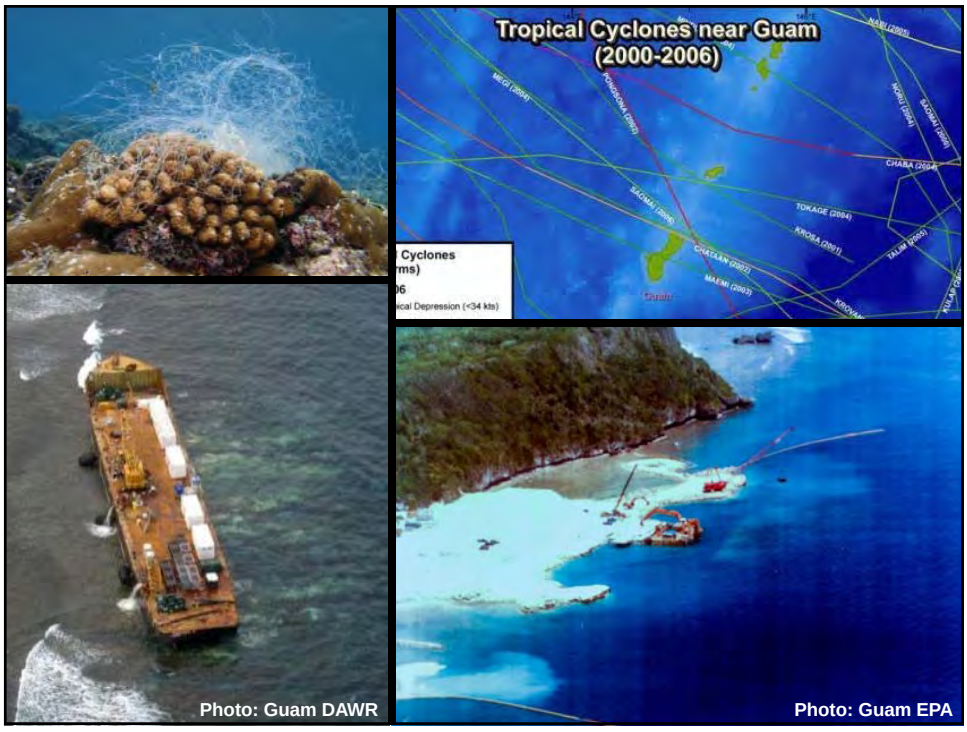
Status of Guam's Reefs: Reef flats/lagoons

- 2013/2014: Lost ~50% of staghorn corals island-wide*
- 2015/2016: Observed additional mortality, not yet quantified

*Raymundo et al. (In review)


Photo: Mark Defley



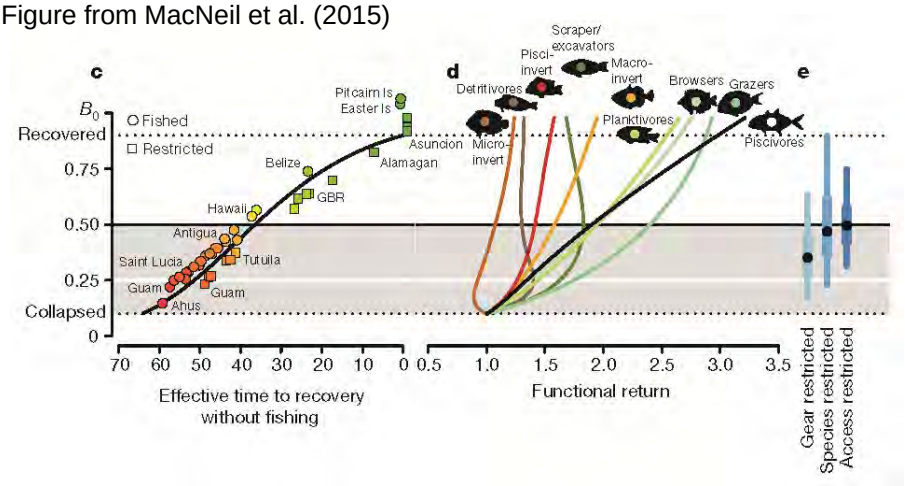

Tropical Cyclones near Guam
(2000-2006)
Photo: Guam DAWR
Photo: Guam EPA

Inhibiting reef recovery:

- ❑ Chronically impaired water quality
- ❑ Limited coral recruitment / heavy reliance on self-seeding
- ❑ Few large herbivorous fishes
  - Mostly smaller parrotfishes
    - 2014 CREP: 92% of ind/~70% of biomass

36th U.S. Coral Reef Task Force Meeting — The Status of Guam's Coral Reefs

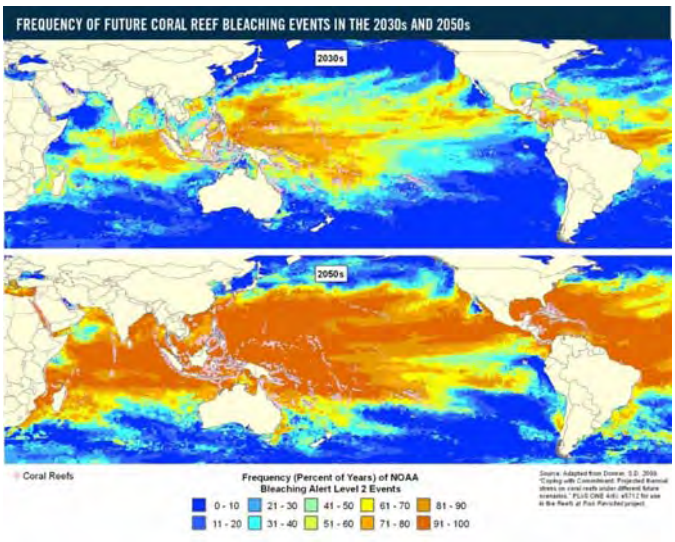
Figure from MacNeil et al. (2015)

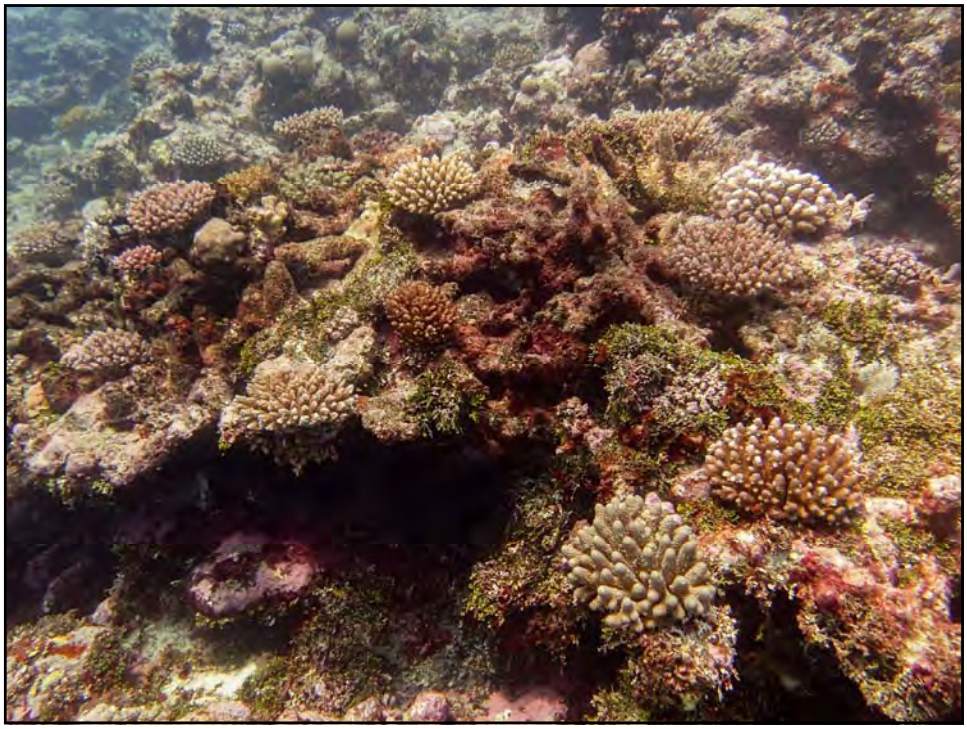


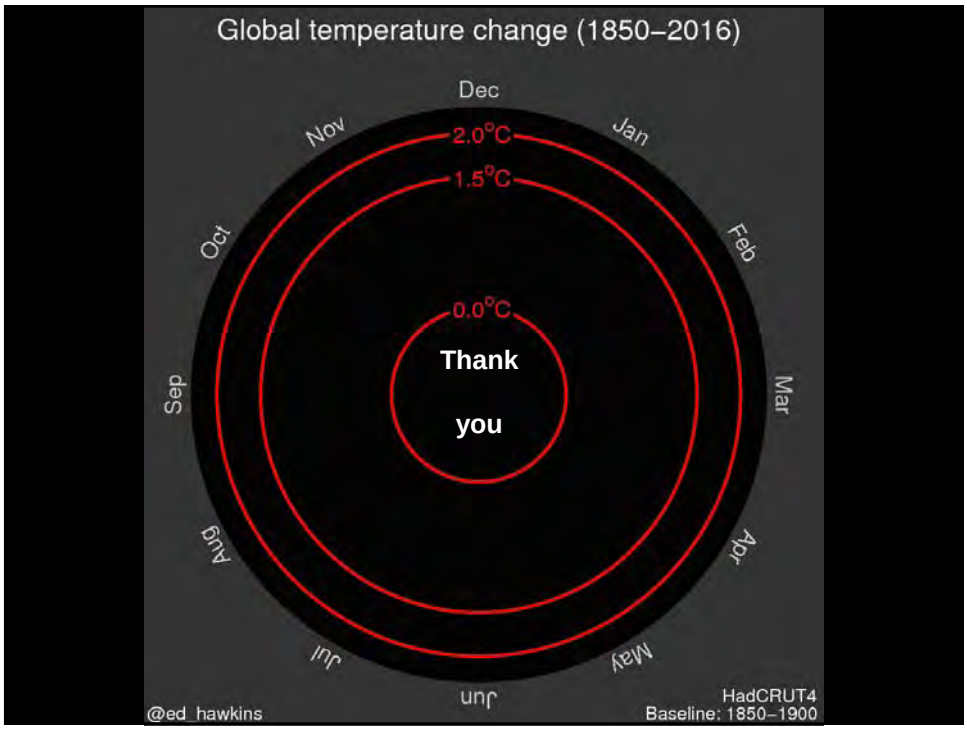
2014 CREP fish data: Mean total fish biomass = ~210 kg/hectare

36th U.S. Coral Reef Task Force Meeting — The Status of Guam's Coral Reefs

Near-annual mass coral bleaching events by 2030





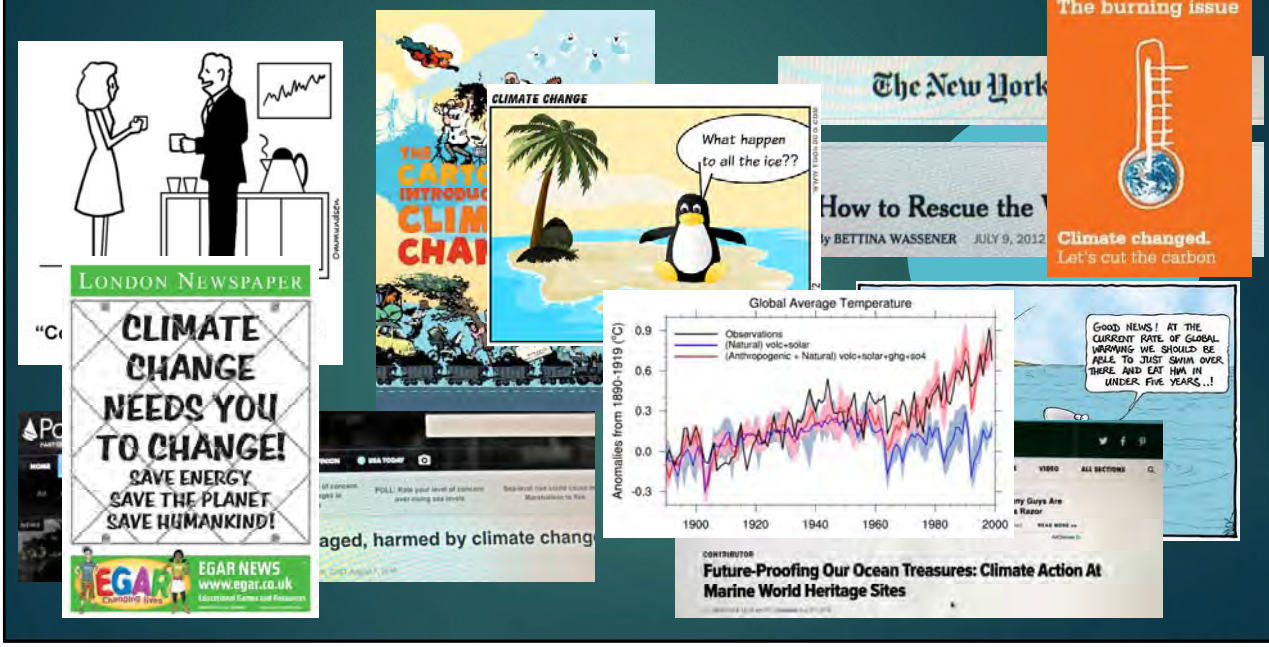

Global temperature change (1850–2016)
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
2.0°C
1.5°C
0.0°C
Thank
you
@ed_hawkins
HadCRUT4
Baseline: 1850–1900

Climate Change and the Future of Guam Coral Reefs

DR. LAURIE RAYMUNDO

UNIVERSITY OF GUAM MARINE LABORATORY

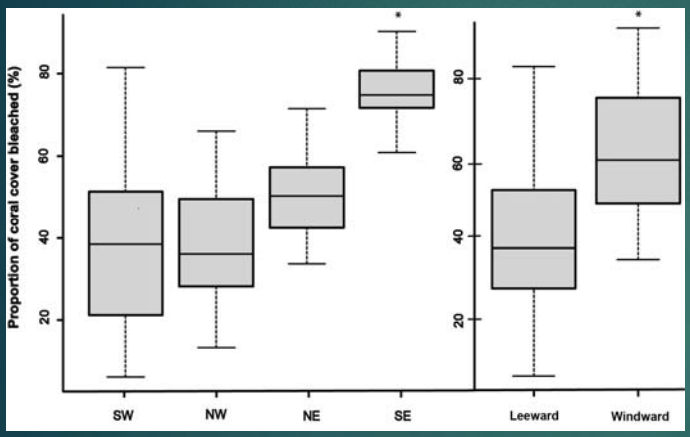
Climate Change and its impacts are now household words



How is climate change affecting our coral reefs?

- **Warming seawater temperatures:** corals are being tipped beyond their threshold
- **Extreme weather events:** will they become more frequent?
- **Ocean acidification:** will this mean corals cannot calcify as much and as quickly?
- **Sea level rise:** will our reefs be able to calcify fast enough to grow at their preferred depth?

2013: the first serious bleaching event in the Marianas in recent history: 85% of coral taxa



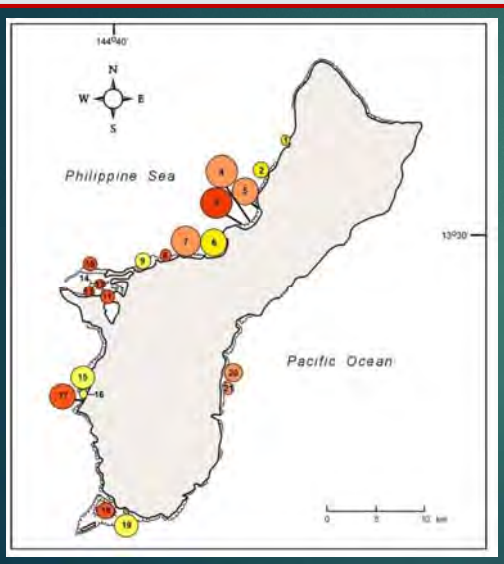
Bleaching in Guam shallow forereefs, August-December 2013. Reynolds (M.Sc. Thesis 2016)

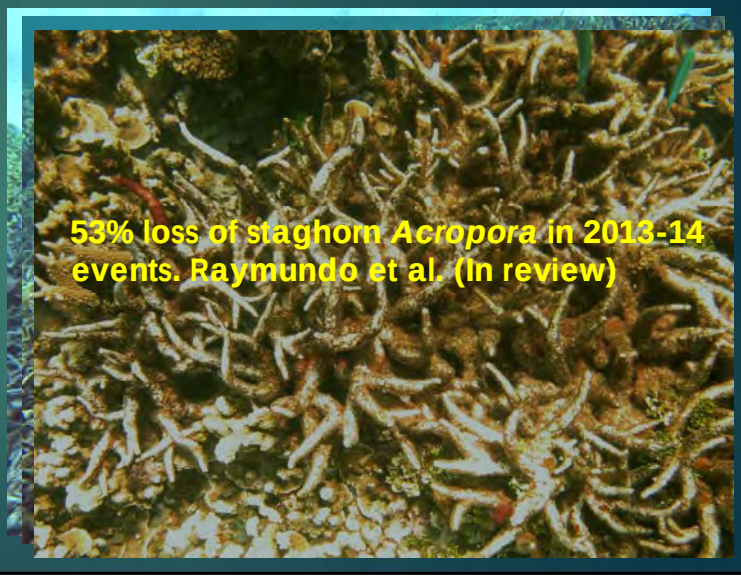
Fadian Pt, Guam

Saipan Lagoon, CNMI

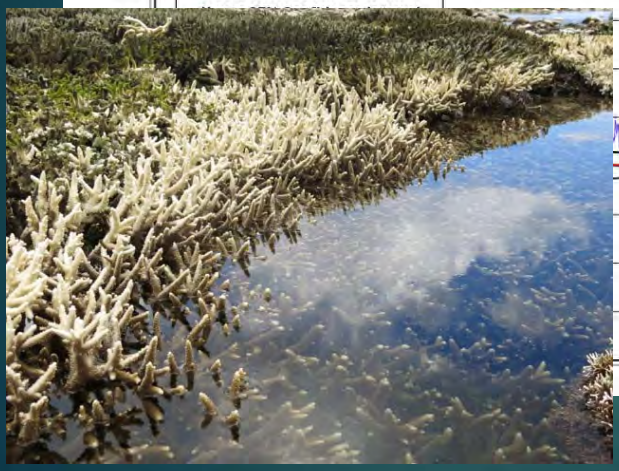
Reynolds et al. 2014

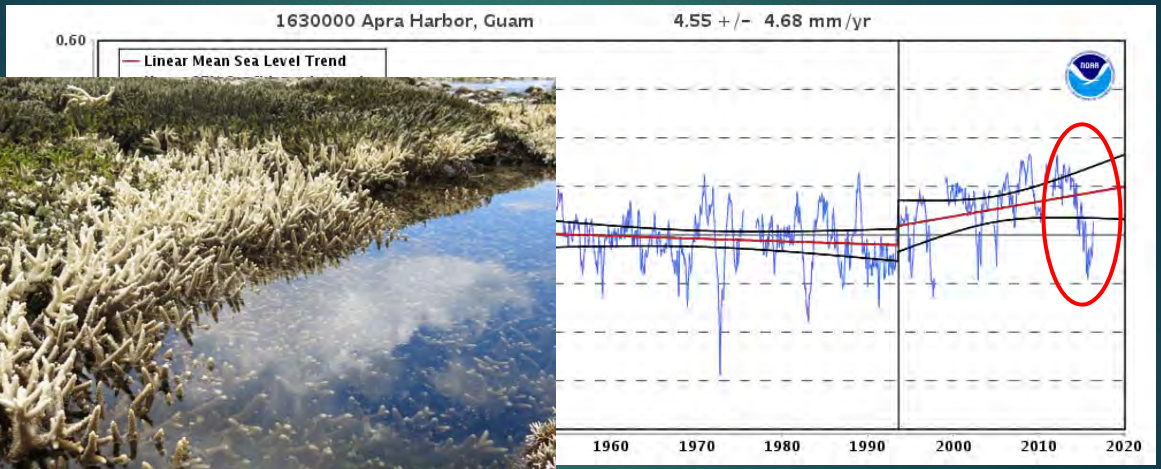
2014: 2nd bleaching event, June-July, affecting shallow staghorn *Acropora* in Guam and Saipan





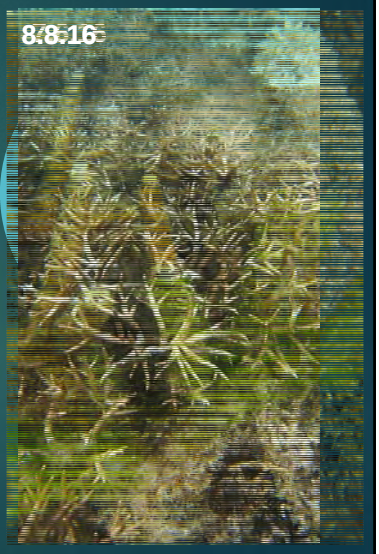
2015: ENSO-related extreme low tides; reef flats exposed for prolonged periods during dry season





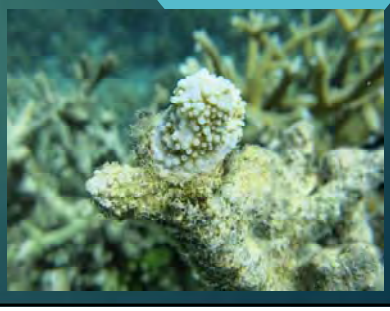
2016: A bleaching-and-disease double whammy

TUMON BAY MARINE PRESERVE



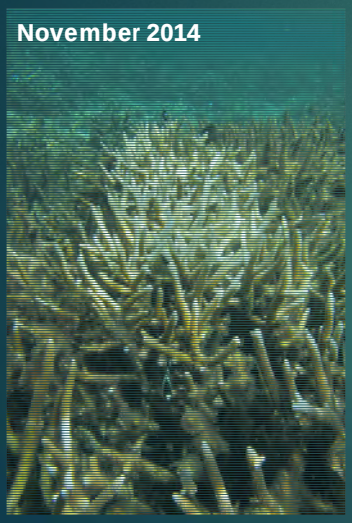
Future prognosis and management options?

- Guam Bleaching Response Plan formalized & implemented
- Identification of resilient pop'ls & favorable sites
- Active mitigation to facilitate recovery of staghorns



Are there resilient communities in favorable sites?

West Agana Sewage Treatment Plant



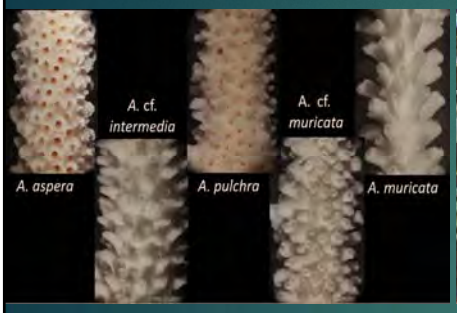
Mitigation: 1. Establishing reproductive biology & genetic analysis of Guam's staghorns

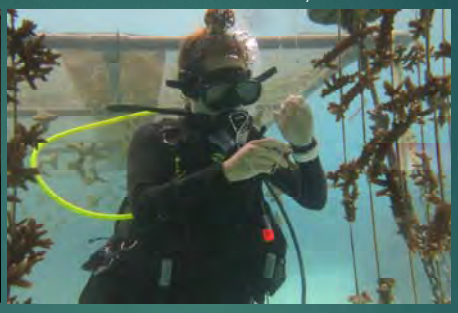
Species	Spawning Timing (2015)	Max. Avg. Egg Size (µm)	Range of egg size (µm) at spawning month	% Fecund Fragments (Total)	Total Number of Fragments
Acropora acuminata	April	580	391-782	19.4%	144
Acropora aspera	September	627.8	207-1150	53.4%	236
Acropora pulchra	May	588.7 (695.1 without Tumon)	46-1058	41.4%	382
Acropora muricata	May	474.3	230-828	28.0%	254
Acropora cf. muricata "B"	May	468.1	253-713	71.4%	126

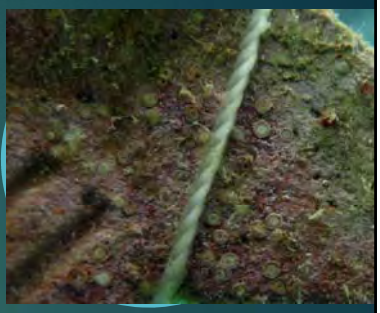
Val Lapacek, M.Sc. thesis

2. Culture of species of concern, using both sexual & asexual propagation

Niki Burns, M.Sc. Thesis







Four species of staghorns: *Acropora pulchra, A. aspera, A. muricata, A. intermedia.* More spp. to be added

~800 fragments in ocean nursery from surviving resilient populations. Pruning to create next generation

Outplanting of tiles containing sexual recruits after nursery grow-out

...."Think globally, Act locally"

→ *Reducing local human impacts on reefs, to help corals cope with global stress*

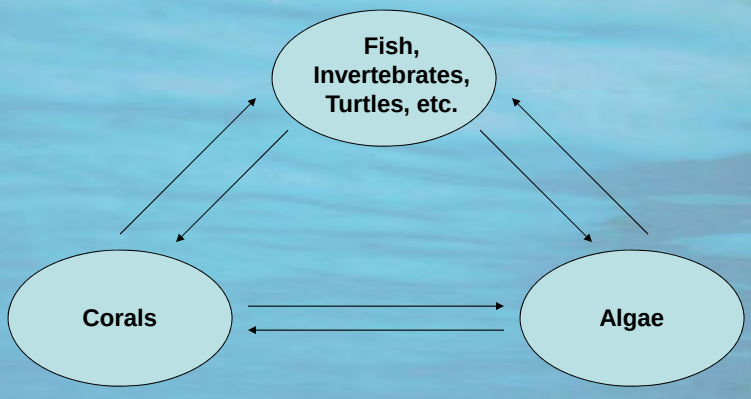
- **DON' T TOUCH/KICK/ ENTANGLE/SIT ON CORALS**
- **USE NON-TOXIC SUNSCREEN (NO OXYBENZONE)**
- **DISPOSE OF GARBAGE RESPONSIBLY**
- **GET INVOLVED!!!**

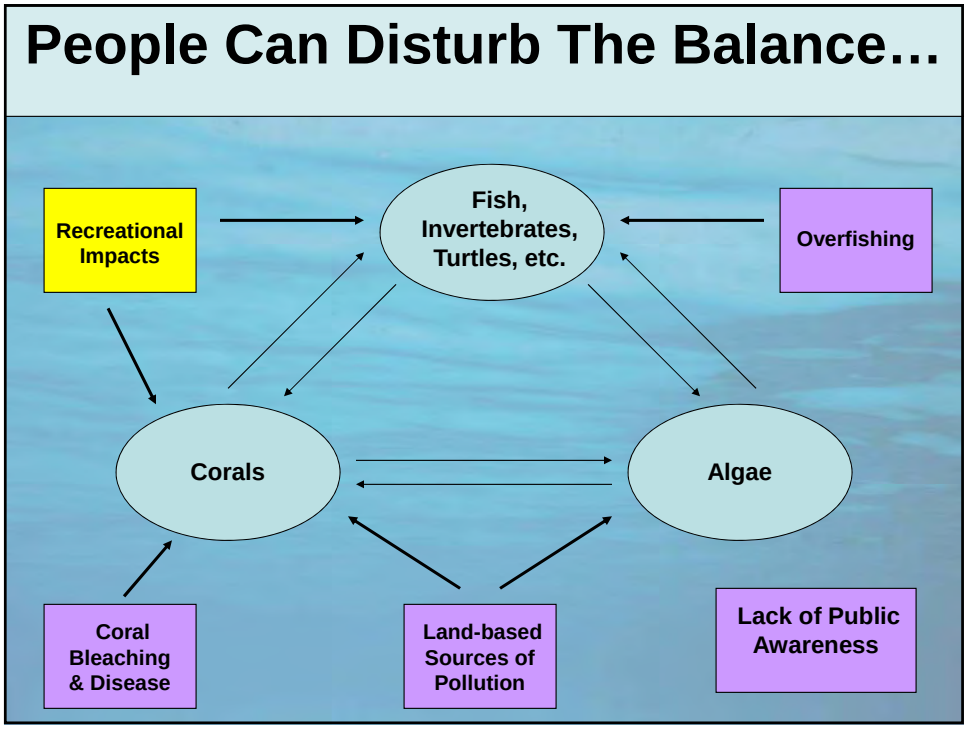

Si Yu'us Maase
Funding & support from
NOAA Coral Reef Conservation Program
Guam Coral Reef Initiative
National Parks Service
Underwater World, Inc.
SECORE International, Inc.
Photo credits: P. Houk, V. Lapacek, D. Burdick, N. Burns, J-W Staman
secore international

Recreational activities and their potential impacts to Guam's coral reefs

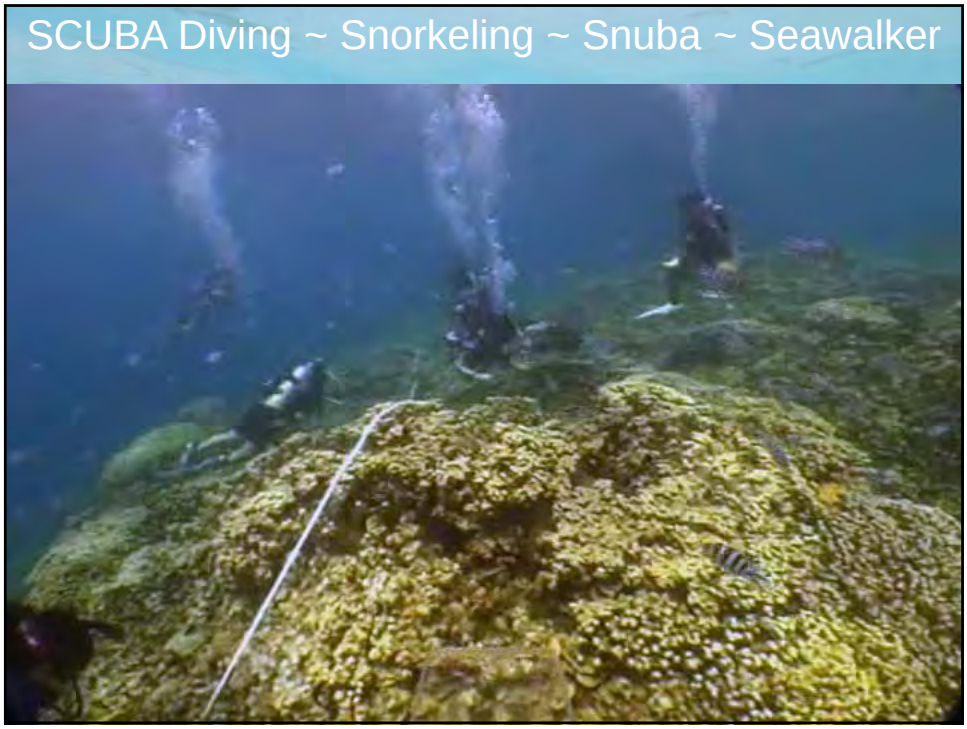
Dave Burdick, Biologist, Guam Coastal Management Program

The Balancing Act



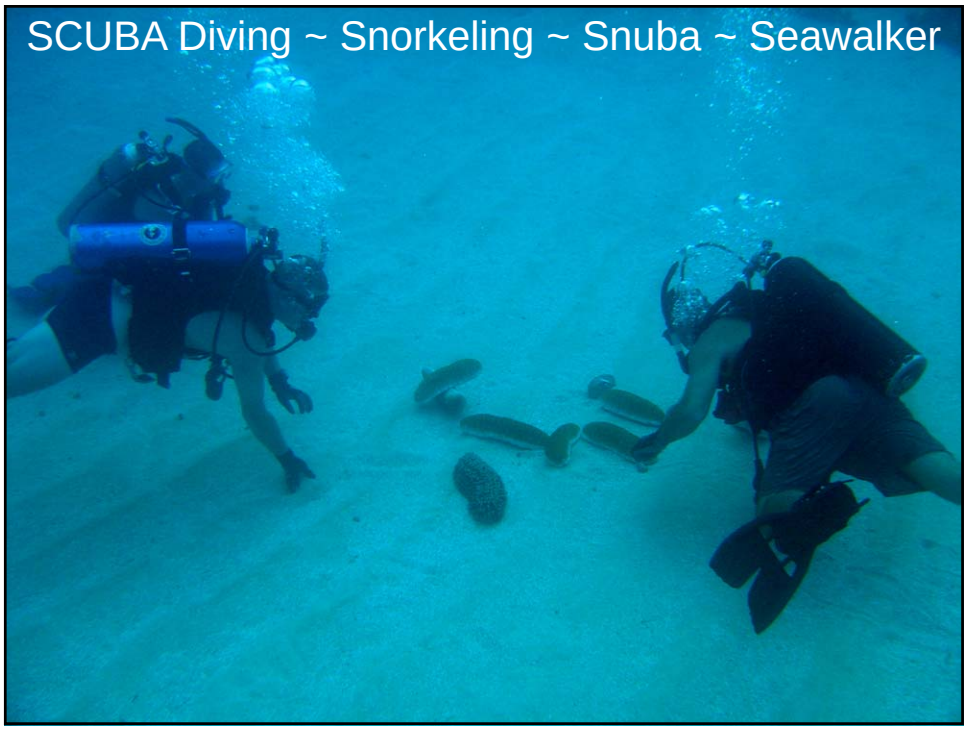

People Can Disturb The Balance…
Recreational Impacts
Fish, Invertebrates, Turtles, etc.
Overfishing
Corals
Algae
Coral Bleaching & Disease
Land-based Sources of Pollution
Lack of Public Awareness

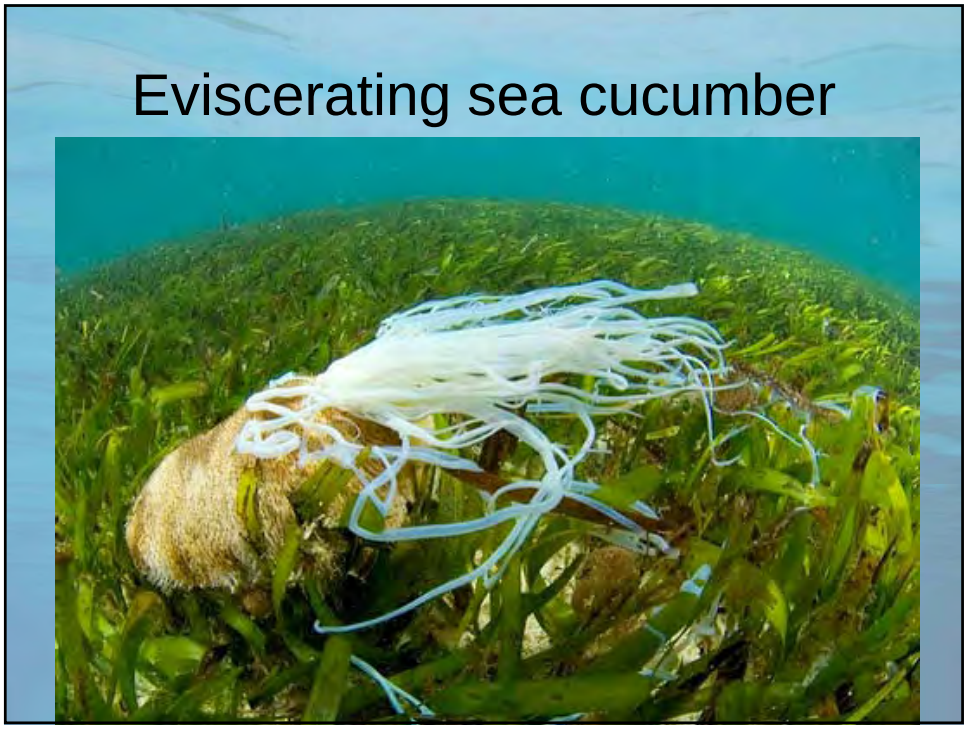

SCUBA Diving ~ Snorkeling ~ Snuba ~ Seawalker


SCUBA Diving ~ Snorkeling ~ Snuba ~ Seawalker


SCUBA Diving ~ Snorkeling ~ Snuba ~ Seawalker


SCUBA Diving ~ Snorkeling ~ Snuba ~ Seawalker


SCUBA Diving ~ Snorkeling ~ Snuba ~ Seawalker

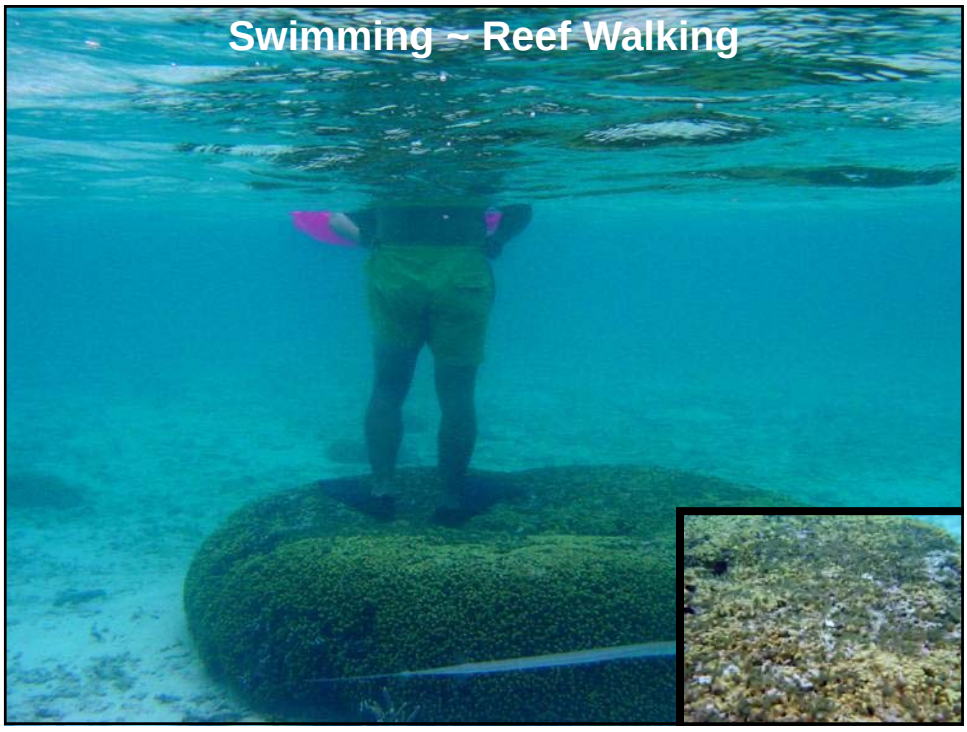

Eviscerating sea cucumber


SCUBA Diving ~ Snorkeling ~ Snuba ~ Seawalker


SCUBA Diving ~ Snorkeling ~ Snuba ~ Seawalker


SCUBA Diving ~ Snorkeling ~ Snuba


SCUBA Diving ~ Snorkeling ~ Snuba ~ Seawalker


Swimming ~ Reef Walking


Swimming ~ Reef Walking

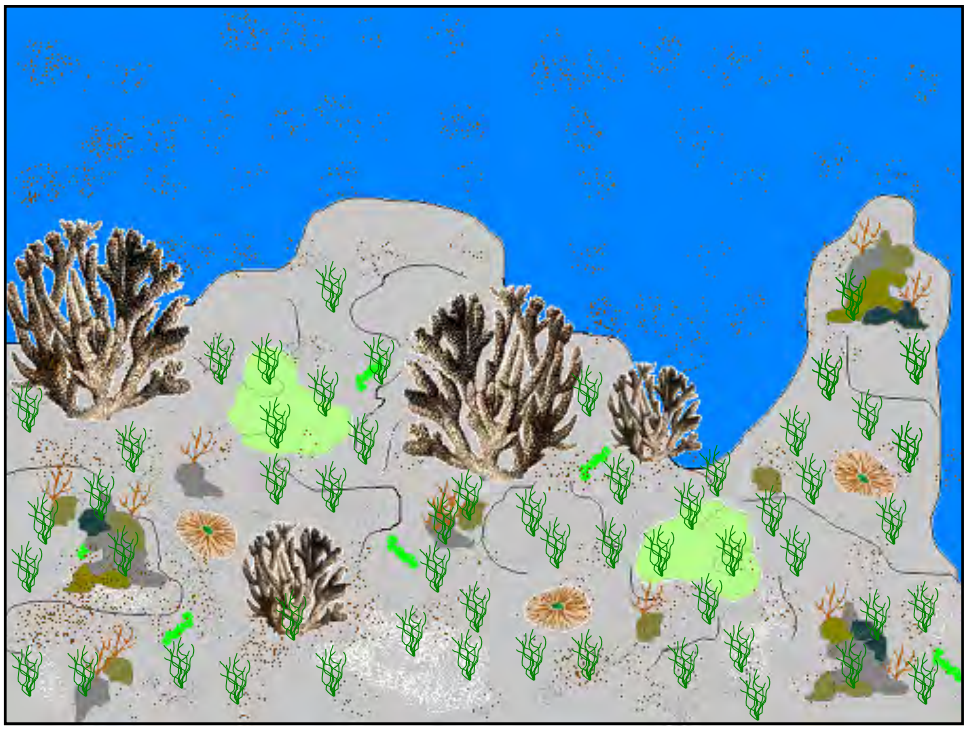

Swimming ~ Reef Walking

Fish feeding

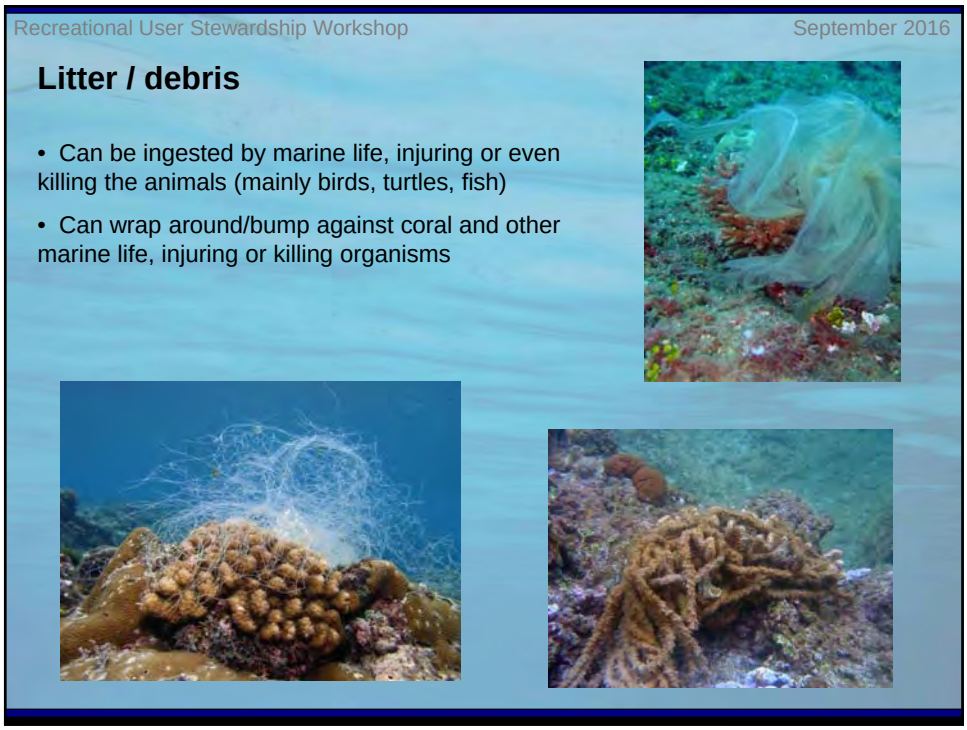
- Certain foods may harm fish
  - Hot dogs, bread, etc. not normal diet of fish
- Increases fish aggressiveness
- Potentially alters ecosystems
  - Fed fish likely aren't consuming their natural food (other fish, algae, etc.) at normal levels

Corals and Algae in a Reef Without Herbivores….

(Hughes et al 2007)




Scrapers/Small Excavators
Grazers/Detritivores
Fish Jobs
Large Excavators/Bioeroders
Browsers
©guamreeflife.com


Recreational User Stewardship Workshop
September 2016
Litter / debris
• Can be ingested by marine life, injuring or even killing the animals (mainly birds, turtles, fish)
• Can wrap around/bump against coral and other marine life, injuring or killing organisms

Recreational User Stewardship Workshop September 2016

Marine mammal/turtle watching

Potentially damaging behaviors:

- Actions that alter animal's natural behavior (e.g. by feeding, "herding," chasing)
- Touching (especially "riding")

- All turtles are protected by Endangered Species Act as well as by local laws
- All marine mammals are protected by the Marine Mammal Protection Act
- Violating these laws is a federal offense and can result in stiff penalties

Recreational User Stewardship Workshop September 2016

Improper anchoring/mooring

- Poorly-placed anchors can damage coral and other organisms
- Anchor/mooring chains can drag across coral if poorly placed

Recreational User Stewardship Workshop September 2016

Personal watercraft (Jet Skis, Wave Runners, etc.)

Potentially damaging behaviors:

- Grounding
- Improper fueling
- Physical disturbance of reef communities (e.g., seagrass beds)
- Resuspension of sediment
- Pollutants from exhaust

Photo courtesy of www.travelmart.net

Photo courtesy of Gerry Davis

Recreational User Stewardship Workshop September 2016

Kayaking/Paddleboats

Potentially damaging behaviors:

- Grounding
- Paddles hitting coral

Photo courtesy of www.travelmart.net

Photo courtesy of www.gregvaughn.com

Recreational User Stewardship Workshop September 2016

Windsurfing/kite boarding

Potentially damaging behaviors:

- Grounding
- Falling off board

Mainly concerned with beginners operating in shallow areas with high coral cover (e.g., Ypao)

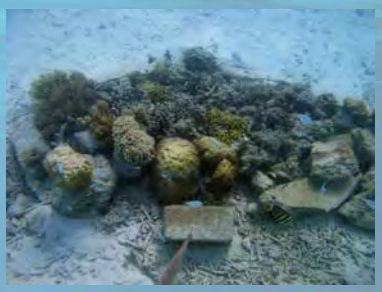
Photo courtesy of www.enjoy.ne.jp

Photo courtesy of www.kiteboardingguam.com

Recreational User Stewardship Workshop September 2016

Other potentially damaging activities

- Improperly-placed (and illegal) artificial reef structures
- Human-constructed “natural” reefs
- Jackhammering reef



OurReefs,OurFuture

Eyes of the Reef

EORMarianas.org

Whitney Hoot
NOAA Coral Reef Management Fellow
Guam Bureau of Statistics and Plans
29 September 2016

Eyes of the Reef Marianas

- EOR Marianas launched in November 2015
- Earlier programs in Australia & Hawaii
- Community-based early warning system
- Supports local reef managers

Guam's Coral Reef Response Team

Early warning → Rapid response

BUREAU OF STATISTICS & PLANS

UNIVERSITY OF GUAM

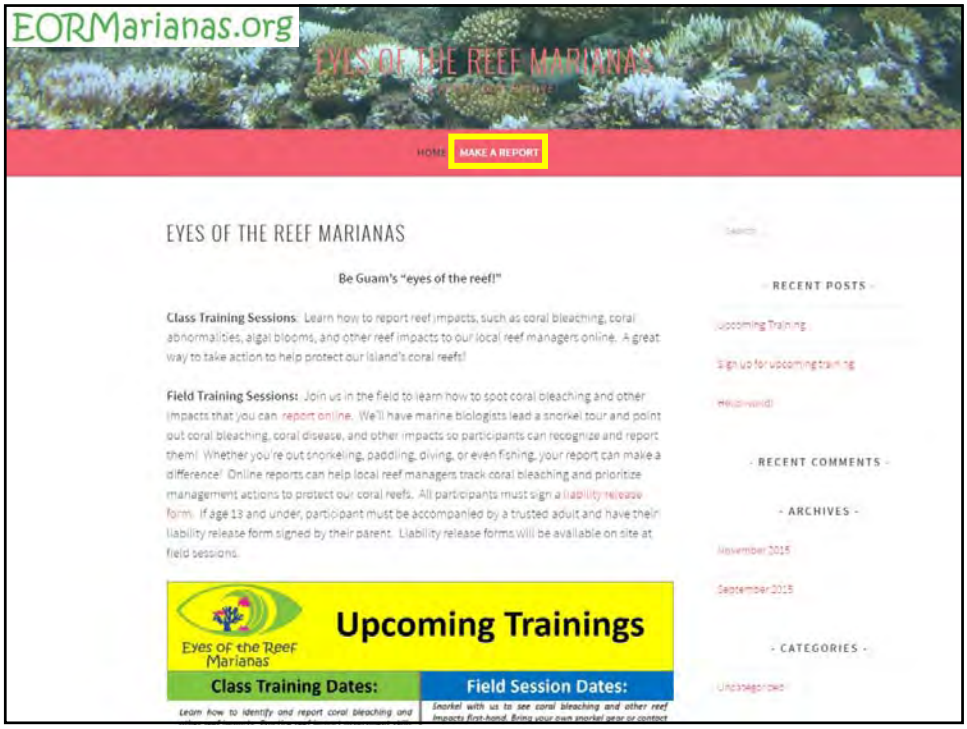
GUAM ENVIRONMENTAL PROTECTION AGENCY 1973

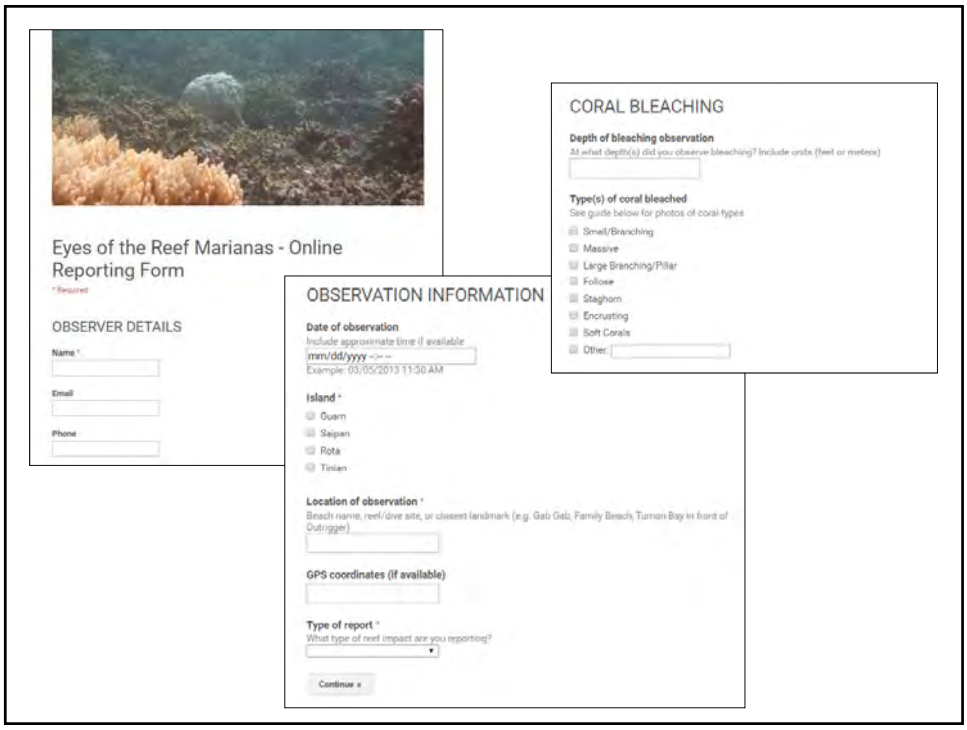
NATIONAL PARK SERVICE

DEPARTMENT OF AGRICULTURE GOVERNMENT OF GUAM

NOAA

EOR participants learn how to identify reef impacts and report them online


EORMarianas.org
EYES OF THE REEF MARIANAS
HOME
MAKE A REPORT
EYES OF THE REEF MARIANAS
Be Guam's "eyes of the reef!"
Class Training Sessions: Learn how to report reef impacts, such as coral bleaching, coral abnormalities, algal blooms, and other reef impacts to our local reef managers online. A great way to take action to help protect our island's coral reefs!
Field Training Sessions: Join us in the field to learn how to spot coral bleaching and other impacts that you can report online. We'll have marine biologists lead a snorkel tour and point out coral bleaching, coral disease, and other impacts so participants can recognize and report them! Whether you're out snorkeling, paddling, diving, or even fishing, your report can make a difference! Online reports can help local reef managers track coral bleaching and prioritize management actions to protect our coral reefs. All participants must sign a liability release form. If age 13 and under, participant must be accompanied by a trusted adult and have their liability release form signed by their parent. Liability release forms will be available on site at field sessions.
Eyes of the Reef Marianas
Upcoming Trainings
Class Training Dates:
Field Session Dates:
- RECENT POSTS -
Upcoming Training
Sign up for upcoming training
Welcome!
- RECENT COMMENTS -
- ARCHIVES -
November 2015
September 2015
- CATEGORIES -
Uncategorized


Eyes of the Reef Marianas - Online Reporting Form
OBSERVER DETAILS
Name *
Email
Phone
OBSERVATION INFORMATION
Date of observation
Include approximate time if available
mm/dd/yyyy
Example: 03/05/2013 11:30 AM
Island *
Guam
Saipan
Rota
Tinian
Location of observation *
GPS coordinates (if available)
Type of report *
What type of reef impact are you reporting?
Continue »
CORAL BLEACHING
Depth of bleaching observation
Type(s) of coral bleached
See guide below for photos of coral types
Small/Branching
Massive
Large Branching/Pillar
Foliose
Staghorn
Encrusting
Soft Corals
Other:

So far…

- Two-hour classroom training sessions, held at:
  - Underwater World
  - UOG Marine Lab
  - MDA & Axe Murderer
  - NOAA Office
- One-hour field sessions in:
  - Tumon Bay
    - Ypao Beach
    - Outrigger
  - Piti
  - Merizo

More than 130 participants have completed training

Average post-test score
26% higher than pre-test

What's next?

- Underwater field guides
- Increased presence on social media
- Incentives for report submission
- Online tutorials
- Mobile app

fb.me/eormarianas

Why is EOR important?

- Opportunity to learn and get involved
- Early warning → rapid response
- Prioritize actions and sites
- Increase coral reef

RESILIENCE

Si Yu'os Må'åse!

Our Reefs, Our Future

Eyes of the Reef
EORMarianas.org

Attend our next training!
Tuesday, October 11th, 6:00-8:00pm
Location TBD
Register on our website

One Ocean Community:

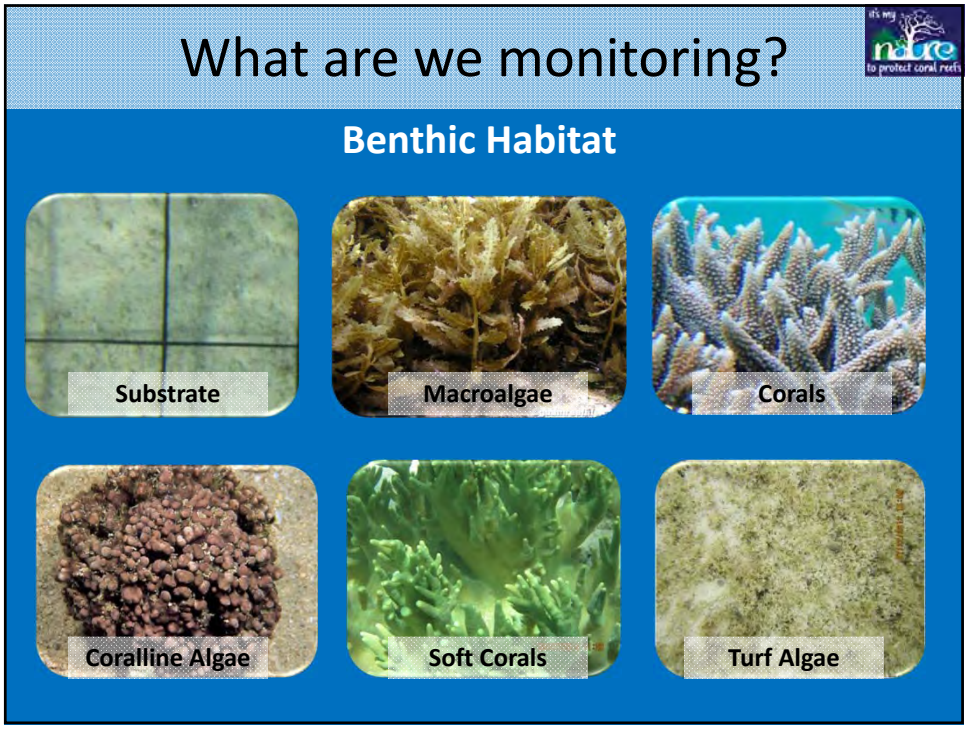
Guam Community Coral Reef Monitoring Program

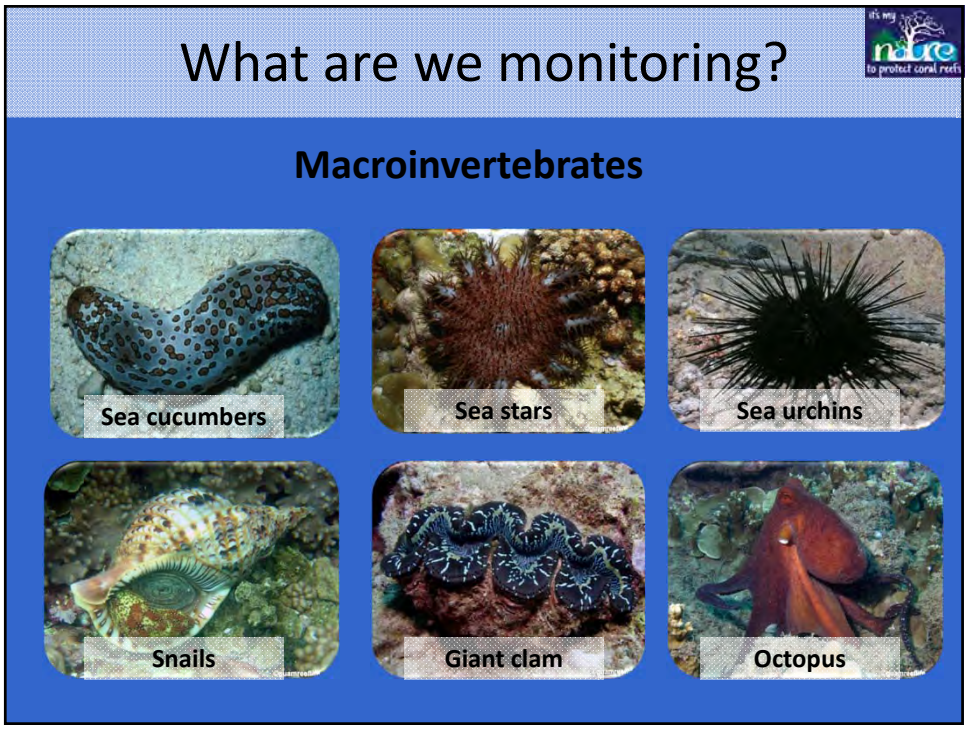
marybelle.quinata@noaa.gov
Guamreefmonitoring.wordpress.com

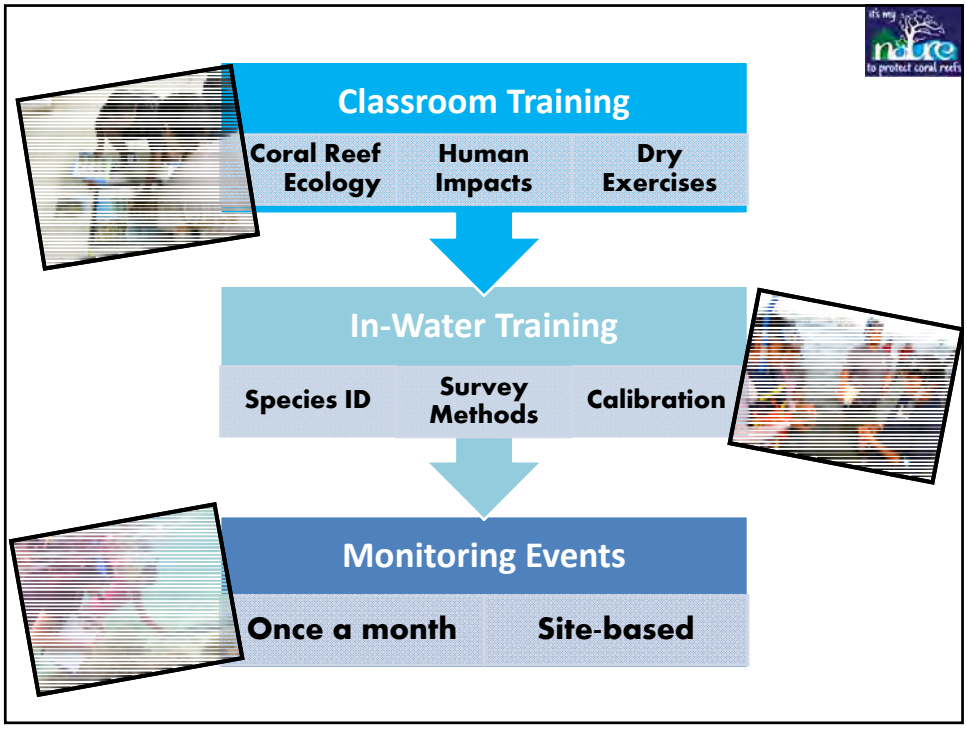
Marybelle Quinata
The Baldwin Group, Inc.
GCCRMP/ NOAA Fisheries

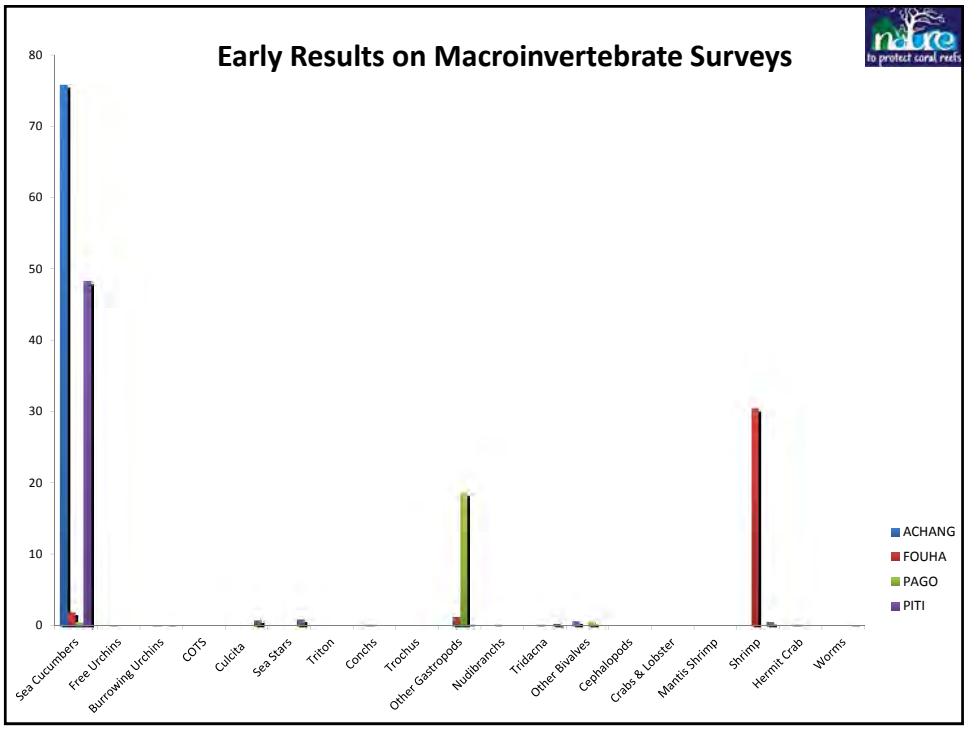
Why a monitoring program?

- For residents that want to get involved with protecting reefs
- Launched in 2012


What are we monitoring?
Benthic Habitat
Substrate
Macroalgae
Corals
Coralline Algae
Soft Corals
Turf Algae

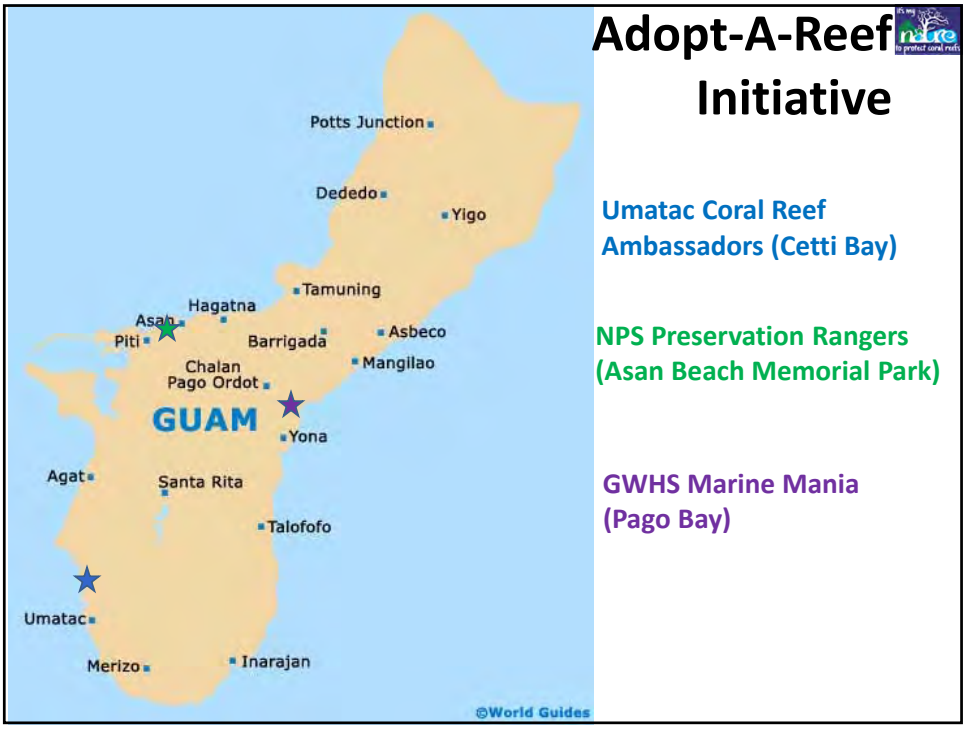

What are we monitoring?
Macroinvertebrates
Sea cucumbers
Sea stars
Sea urchins
Snails
Giant clam
Octopus


Classroom Training
Coral Reef Ecology
Human Impacts
Dry Exercises
In-Water Training
Species ID
Survey Methods
Calibration
Monitoring Events
Once a month
Site-based


Early Results on Macroinvertebrate Surveys
80
70
60
50
40
30
20
10
0
Sea Cucumbers
Free Urchins
Burrowing Urchins
COTS
Culcita
Sea Stars
Triton
Conchs
Trochus
Other Gastropods
Nudibranchs
Tridacna
Other Bivalves
Cephalopods
Crabs & Lobster
Mantis Shrimp
Shrimp
Hermit Crab
Worms
ACHANG
FOUHA
PAGO
PITI

Adopt-A-Reef Initiative

- Learn how to do coral reef monitoring
- Fun family activity – teach them what you know about our reefs
- Share your knowledge and stories with customers


Adopt-A-Reef Initiative
Potts Junction
Dededo
Yigo
Tamuning
Hagatna
Asan
Piti
Barrigada
Asbeco
Mangilao
Chalan
Pago Ordot
GUAM
Yona
Agat
Santa Rita
Talofofo
Umatac
Merizo
Inarajan
©World Guides
Umatac Coral Reef Ambassadors (Cetti Bay)
NPS Preservation Rangers (Asan Beach Memorial Park)
GWHS Marine Mania (Pago Bay)


Started working with tourism industry in 2015

Other Program Activities

Human-use Monitoring

- Monitor recreational activities at beach sites
- Can inform outreach efforts

Science Sunday

- Casual public talks featuring research/conservation on Guam or Micronesia
- Public discussion and ask questions directly to scientists

Si Yu'os Ma'åse!

Email gureefmonitoring@gmail.com

Websites: guamreefmonitoring.wordpress.com

Facebook: facebook.com/gureefmonitoring

O-ZONE Partnership in 2016

- Families learned more about conservation at Tåsi Mini-Fair on World Ocean's Day

- Outrigger staff and guests attended EOR Marianas field session

PROTECT

Best Management Practices for Recreation

Save Our Reefs:
Recreational Tour Operators Workshop
September 29, 2016

Val Brown
NOAA Fisheries

Best Management Practices

- Methods that have been determined to be the most effective, practical means of preventing or reducing the impacts of recreational activities on coral reefs.
- Examples:
  - Snorkeling, Scuba
  - Boating

Reef Pledge

I, _____, commit to minimize my impact to the sensitive coral ecosystem by following the rules of responsible marine recreation listed below.

I pledge to:

1. Always listen to my guide and/or instructor and follow his or her advice. Following safety guidelines can save my life and help to protect the reef.
2. NEVER touch, step on or kick coral reefs or live rock; corals are living animals that eat, grow and reproduce and can be damaged by contact.
3. NEVER throw food or trash into the water or feed fish. Human food and bought fish food can make fish and other marine life sick and disrupt the natural interactions between reef organisms that keep the ecosystem healthy.
4. NEVER chase, touch, or try to move or manipulate marine life. This can stress and harm the animals. If they want to approach me, it will be their choice.
5. I understand that if I disregard or knowingly violate these rules of responsible marine recreation I could be excluded from further activities without right to refund and my behavior may be reported to other dive centers.

Signature: _____ Date: _____

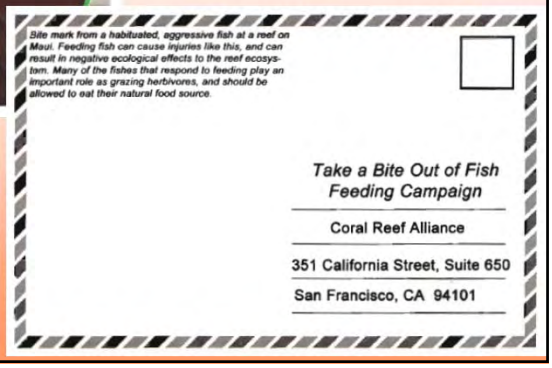
Peak Performance Buoyancy

- When was the last time your shop offered a Buoyancy Clinic?

Fish Feeding

Take a Bite Out of Fish Feeding Postcard Campaign

Sponsored by the Coral Reef Alliance



MAUI
- Ann Fielding's Snorkel Maui
- Boss Frog's Dive & Surf
- Kai Kanani
- Lahaina Divers
- Maui Dreams Dive Company
- Maui Ocean Center Aquarium
- Maui Sights and Treasures
- Maui Thrills Eco-Nature Tours
- Mike Severns Diving
- North Shore Explorers
- Pacific Dive
- Pacific Whale Foundation
- Pride of Maui
- Prince Kuhio
- Trilogy Excursions
- West Maui Sports and Fishing Supply

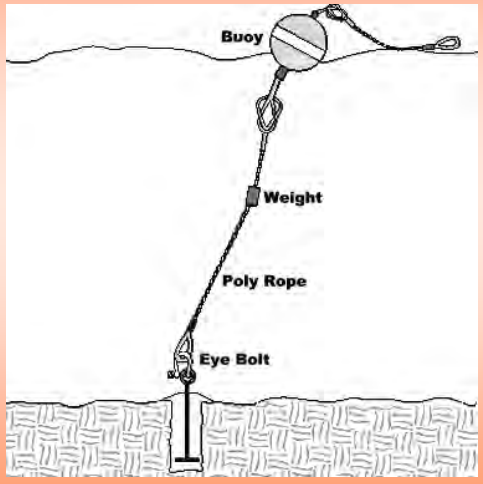
HAWAII ISLAND
- Adventures in Paradise
- Bottom Time Hawaii
- Dorkel's Snorkel and Baby Rental
- Jack's Diving Locker
- Kona Boys
- Konaquatica Dive Center
- Miller's Snorkel and Surf
- South Pacific Kayaks & Outfitters

OAHU
- Island Divers
- Mokulua Kayak Guides
- Surfin Waikiki at the Queen Kapi'olani Hotel
- Wild Side Specialty Tours

KAUAI
- Kayak Hanalei

OTHER SUPPORTERS
- For the Sea Productions
- Hawaii Wildlife Fund
- Malama Kai Foundation

Mooring Buoys



<u>Easy To Use:</u>

Pick up line at top of buoy with a hook or hand

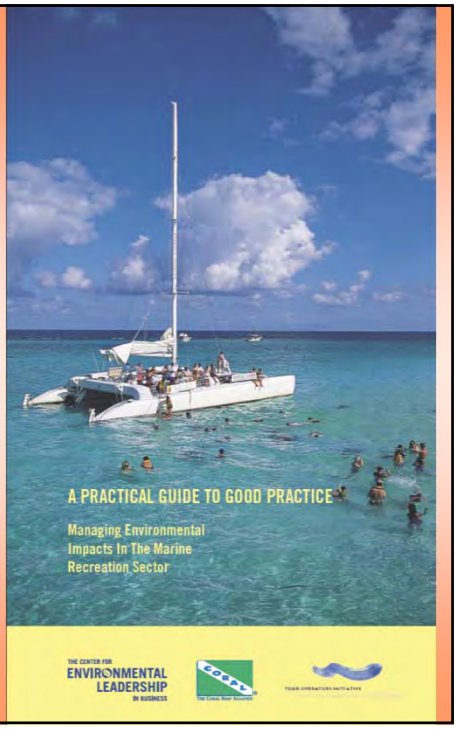
Pass your line through the loop at the end and tie off on your cleat

Occupy for no more than 3 hours

Cast Off!

For More Information:

A Practical Guide To Good Practice



What Can You,
Your Organization, or
Your Employees do to
MINIMIZE
Recreational Impacts
on our Reef Environment?

Let's Explore the Options….

Scenario 1:

Diving – Photography Damage

You're the divemaster on a boat taking divers to the Piti Bomb Holes Marine Preserve. During the first dive, you noticed some photographers sitting/standing/laying on coral or even breaking coral to get their shots. What will you do to prevent this from happening in the Marine Preserve?

(Hints: Briefings, Signs/Posters, Diver Pledge, Strict Policy against intentional damage)

Scenario 2:

Overcrowding

One of your most popular snorkel sites has recently come under fire by the local community, complaining that the reef is becoming overcrowded with tourists and local families can no longer fish or participate in recreation activities. List some potential management actions which you as an operator can undertake to address this commonly experienced problem.

(Hints: scheduling, alternate site development, constrain snorkeling tour to small area, visit outside the reef by approaching from boat, work with community, government)

Scenario 3:

Diving – Coral Collection

A diver on your scuba tour takes a large chunk of coral onto the boat. The dive master did not see the diver break the coral or bring it up. The coral was clearly living and the participant insists that he/she found it sitting on the bottom and is determined to keep it as a souvenir. How do you/instruct your staff to handle this situation?

(Hints: Briefings, Signs/Posters, Diver Pledge, Strict Policy against intentional damage)

Scenario 4:

Snorkeling

You work in a recreational gear rental booth in Tumon. As you fit a couple with snorkeling gear, it becomes apparent that they have never snorkeled before. What can you or your company do to make sure that the couple has an enjoyable experience and prevent damage to the preserve's resources?

(Hints: life preservers, lessons, guided snorkel)

Scenario 5:

Dolphin Watching

You are the captain of a boat operating in Agat Bay full of tourists on a dolphin watching tour. As you arrive at the site, you put your boat in neutral and the dolphins come closer. All of a sudden, one of the passengers jumps in and tries to ride one of the dolphins. You know that this is illegal under the Marine Mammal Protection Act. What should you do?

(Hints: briefings before leaving dock, strict removal policy, sign pledge of safe viewing guidelines, posters/ signs, dolphin education)

Scenario 6:

Paddling

You are organizing a big outrigger canoe race. The race will include a number of different types of courses. How will you minimize impacts to the marine resources in your race area?

(Hints: Siting – use less fragile area/bay (provide benthic habitat maps of E. Agana and Tumon, work with local resource agencies to avoid coral, consult tide charts for high tide, brief participants about sensitive areas, have rules about coral damage (disqualify if break coral, etc)

Scenario 7:

Personal Water Craft

You are the owner of a jet ski operation that uses courses in East Agana Bay. How would you organize your business to protect the marine resources? Specifically address: courses, instruction, fueling

(Hints: tidal changes, habitat, don't fuel in the water, spill management and containment plans, keep vehicles off beach, out of water, instructions to staff and customers, pledge to use responsibly)

Scenario 8:

Diving – Introductory Diving

You are the owner of a dive shop/operation that specializes in introductory or "teiken" diving. Someone has noticed that one or more of your instructors/divemasters is

regularly instructing your customers to hold onto coral and feed fish. You know that this is not a good practice. What will you do to remedy the situation?

(Hints: training program for instructors/divemasters, pledge for divers and instructors, do not provide fish food, check your operations regularly, use less sensitive sites).

Scenario 9:

Diving – Instructors

You are a dive instructor. The shop you work for has pledged to become more eco-friendly and expects all of their instructors to support this effort. What will / can you do through your classes to be more reef friendly and help your student divers be more reef friendly?

(Hints: site selection, buoyancy control, talk about importance of reefs, diver pledge, pickup trash on beach and dives, exhibit good role model behavior – good buoyancy, don't touch coral, no fish feeding)

Scenario 10:

Sea Turtle Harassment

You lead snorkeling adventures in Cocos Lagoon. A participant on your tour excursion begins to touch and harasses a sea turtle while snorkeling. A gentle reminder to the snorkeler from boat staff is met with a hostile attitude and the participant threatens to not tip or come back again. How would you instruct your staff to handle this situation?

(Hints: illegal to handle turtle, education, signs/posters, pledge)

Scenario 11:

Boring Briefings

Always having to provide the same information during interpretation, has left your boat staff fed up giving dry, bland and routine information. Participants seem bored and do not pay attention to what the staff is explaining. What techniques might you implement in order to alter the way information is being provided?

(Hints: update info regularly, find new trivia about the site regularly, bring marine biologists on board for special presentations, contests for staff)

GREEN FINS

不可踩踏珊瑚

不可搅拌泥沙

不可触碰或追赶海洋生物

不可收集活或死的海洋生物

不可喂鱼

不可戴手套

不可乱丢垃圾

浮潜时请穿救生衣

To help protect Guam's reefs, we ask that while you are **DIVING** with us, please...

PRACTICE **ADVANCED BUOYANCY** AND **FINNING TECHNIQUES** TO STAY CLEAR OF MARINE LIFE.

DO NOT CHASE OR TOUCH MARINE LIFE

This can cause great stress to any animal. This can also transmit diseases or remove protective coatings on fish, invertebrates and other species.

Look but never touch; try not to get too close.

DO NOT WEAR GLOVES

In some dive sites it's illegal to use gloves while diving.

Wearing gloves gives you a false sense of protection and encourages you to hold on to things, like coral, underwater.

To help protect Guam's reefs, we ask that while you are **on our BOAT, please...**

NO LITTERING

Marine debris can kill turtles, birds and coral. Show guests where they can dispose of trash.

NO FISH FEEDING

Food thrown overboard attracts fish away from their natural food source. This upsets the food web.

NO COLLECTING MARINE LIFE

If it is found underwater, it should stay underwater. This activity is often illegal and can leave species homeless.

WEAR A LIFE JACKET WHEN SNORKELING

Wearing a life jacket helps you avoid standing on or kicking shallow corals that will take many years to recover.

To help protect Guam's reefs, we ask that while you are **DIVING** with us, please...

PRACTICE **ADVANCED BUOYANCY** AND **FINNING TECHNIQUES** TO STAY CLEAR OF MARINE LIFE.

DO NOT STEP ON CORAL

Watch your feet and fins at all times. Most damaging contacts to the reef come from your fins.

Corals are very fragile and take a long time to grow.

DO NOT STIR THE SEDIMENT

If you are not careful, your fins can stir up the sediment and debris, upsetting sandy habitats and covering nearby corals.

GREEN FINS

산호초 위에 서지 마세요

침전물을 휘젓지 마세요

해양생물을 만지거나 뒤쫓지 마세요

죽거나 살아있는 해양동식물을 수집하지 마세요

물고기에게 먹이 주지 마세요

장갑 착용하지 마세요

쓰레기 버리지 마세요

구명조끼를 착용하세요 (스노컬링 시)

GREEN FINS

珊瑚の上に立たない。

海底の砂をかき回さない。

生き物を触ったり追いかけたりしない。

生きている、死んでいるに拘わらず、生き物を採集しない。

魚に餌をやらない。

手袋をしない。

ゴミを捨てない。

救命胴衣を着用する。
(スノーケルの際)

GREEN FINS

No stepping on coral

No stirring the sediment

No touching or chasing marine life

Do not collect dead or alive marine life

No feeding fish

No gloves

No littering

Wear a life jacket when snorkelling


GREEN FINS
Respect marine life & shoot photos without disturbing the environment
Support conservation & champion Green Fins
Ensure all equipment is secured & do not drag over reefs
Practice buoyancy control & photography skills
Practice advanced finning techniques
Only touch rock or dead coral if necessary
Avoid stirring up sediment by keeping your distance